RAILROAD GAZETTE.

SATURDAY, FEBRUARY 10, 1872.

PATTERSON'S FROG.

The engravings herewith represent a new frog which possesses some new features, and, it is thought, some advantages over those in ordinary use. Figure 1 is a plan view, fig. 2 a side elevation, fig. 3 a longitudinal section, fig. 4 a cross section in the line S, S, of fig. 1, and fig. 5 a cross section in the line T, T. The frog consists of a broad bed-piece of thick rolled iron A, A, which rests on timber, the latter not shown in the engraving. B, B, are the wing rails, and C, C^1, C^2, is the frog point or tongue made of cast steel. The chief peculiarity of the frog consists in the manner in which the point is held to the bed-piece and at the same time secures the wing rails. From fig. 3 it will be seen that the point is cast with lugs, C^4 and C^5, which are let into openings cut into the bed-plate. The point is then secured by two keys, D^1 and D^2 (figs. 1, 3 and 5), which pass through the lugs and secure it to the bed-plate. In figs. 4 and 5 it will be seen that the point is also cast with flanges, C^3, C^3, which lock the base of this rail and hold it to the bed-plate. It will therefore be seen that in order to remove the frog point it is only necessary to drive out the keys D^1 and D^2, and it can then be lifted out without disturbing any other part, or if it is desirable to remove one or both of the wing rails, by simply slackening up the keys the former will be loosened. Besides the flanges on the frog point the wing rails are also held by clips *a*, *a*, formed by punching out a portion of the bed-plate, and bending it up as represented in fig. 4. Clips made separate from the bed-plate have more recently been substituted for those represented in the engraving.

The frog point it will be observed is cast hollow, which increases the elasticity very materially. The advantage which this frog possesses is the great facility with which it can be repaired and the point and wing rails removed when worn out.

They are manufactured by Messrs. Peter Fields & Son, Jersey City.

Fig. 1.

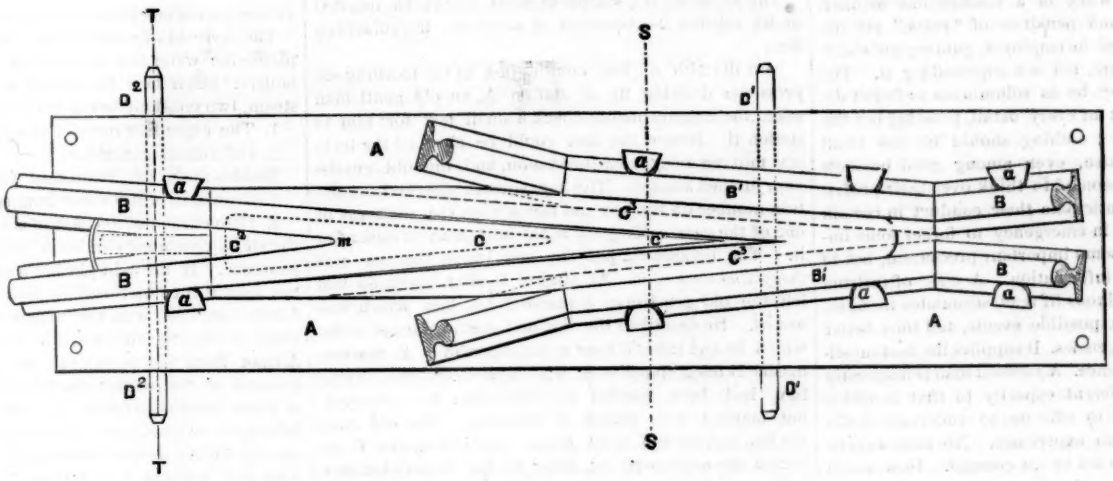


Fig. 2.

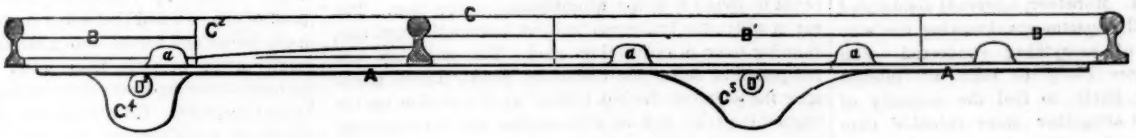


Fig. 3.

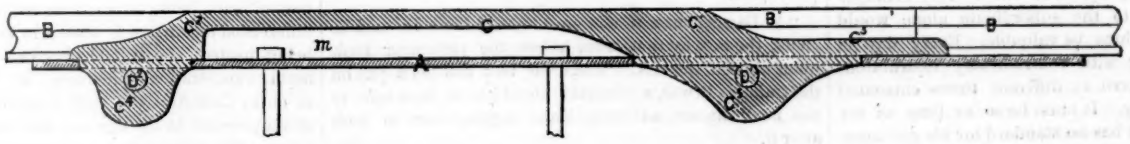


Fig. 4.

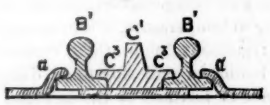
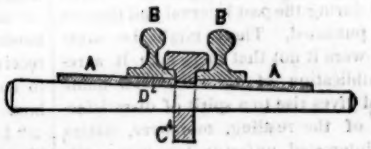


Fig. 5.



PATTERSON'S PATENT STEEL ELASTIC RAILROAD FROG.

Contributions.

NOTES ON THE MANAGEMENT AND DISCIPLINE OF AMERICAN RAILROADS.

BY A HINDOO.

[CONTINUED FROM PAGE 47.]

In the management of his staff a superintendent meets with three persistent enemies, viz.: ignorance, carelessness and willfulness. Of these three, ignorance is the greatest; hydra-headed, it defies extermination. A firm head may lessen the amount of carelessness and almost eliminate willfulness, but strictness is powerless against ignorance. Of course a judicious selection of employes diminishes the quantity of crass ignorance on the line. Therefore, desirable qualities for a manager are firmness, ability to enforce discipline, and knowledge of character. These qualities we generally find combined, possessed by the same individual; but something more is required. When a vacancy occurs it is most often necessary to fill it up without delay, but not always is there at hand a man fit for the place. Most "outsiders"—and, indeed, too many "insiders"—believe that any individual who can read and write passably is good enough for railroading. Railroads are looked upon as refuges for the destitute, as havens of rest for those who have failed in other lines of business. A great mistake is this. The duties of a railroad clerk require of him not a whit less ability and attention than does any other business, without exception; and the more important posts demand of their incumbents the very highest and noblest gifts of mind—the ability to rule one's fellow-men. Also, there are many positions that demand considerable professional knowledge. In the older countries this fact is recognized. Many roads have young men as apprentices, intended ultimately to fill the superior positions, who are taught the general principles and also specially prepared for the places they are intended to take. Unfortunately, on our American roads there is a contempt for details and business-like work which is neither profitable to the shareholders nor creditable to the management. There is also a dearth of men who, looking on railroading as a profession, seek advancement through zeal and solid knowledge of the business, albeit the individuals are smart and quickwitted. Therefore, a management should possess other qualities than those afore-mentioned, viz., firmness, ability to enforce discipline, and knowledge of character. The talent of the teacher is a quality not less desirable, or rather necessary, than any of these three, but is rarely found combined with them. The man who with a hope of success may essay to instruct and educate a large staff of subordinates of many grades and various duties must be endowed with rare gifts of mind.

1. He must thoroughly understand the business in every detail, practically and theoretically.

2. He must be able to put his ideas into terse, clear, explicit language.

3. He must firmly, yet without violence, insist on obedience to every rule.

4. He must patiently watch and detect every infringement on the rules, every irregularity, every want of proper precaution, every want of diligence.

5. He must carefully distinguish between carelessness and ignorance, prompt to punish the former and correct the latter.

6. He must diligently instruct the men as to their responsibilities to the employers on the one hand, and, on behalf of the company, to the public on the other; in the privileges of the company and the rights of the public.

7. He must thoroughly understand and expound to those under him, when necessary, the laws relating to master and servant, corporations, common carriers and other acts having reference to railroads. He should keep himself well informed of the decisions given from time to time in railroad cases.

From this it will be seen that the teacher, however good in his own line, might not make a good manager. To shape a policy, to control men, to defend the rights of the company aggressively perhaps, to lay down principles and lines of conduct, a man of action is required, a man of vigorous, subtle intellect, one who can make up his mind and decide on the spur of the moment. Such a character has generally in it an element of impatience and restlessness. To be a good teacher the man must be patient, watchful, zealous, and, I might say, unambitious. Hence in America we do not find many of the latter class. The genius of the American nation is a restless, conquering activity; ever designing bold, grand figures in the rough, seldom polishing or finishing; making great

and valuable discoveries, leaving the improvement and perfecting of them to others. Now nowhere is the genius of the American people more perfectly shown than on our railroads. The designs, the conceptions are good and progressive, but the details are utterly neglected.

The education of employes is a task not very light, producing no brilliant, flashing results; tedious, thankless and unattractive, yet a *sine qua non* of good management. How can this best be done? A few thoughts on this subject may not be useless to some readers of the GAZETTE.

As I have before remarked, on our roads to-day there is too much of the "*lex loci*," of the "*leges non scriptæ*," too little of the written law. There should be on every road a code of rules and a code of instructions. The code of rules should comprise all regulations necessary to safety of life and property, neglect of any one of which cannot be tolerated and ignorance of which can never be assumed. They should be concise, and as few as are consistent with the object to be attained. The code of instructions should comprise all instructions necessary to the carrying on of the work in a business-like manner, not having the force and penalties of "rules," yet demanding attention from the employes, guiding and assisting individual judgment, but not superseding it. The code of instructions may be as voluminous as found desirable; it should treat of every detail, pointing out the why and the wherefore; nothing should be too small for its notice. Most men, even among good business men, who are not accustomed to think over their professional duties and to anticipate their conduct in certain eventualities, are liable in emergency to forget some important point, to omit some important precaution, not to secure some important information. A code of instructions sufficiently voluminous (if read) stimulates thought, leads men to anticipate possible events, and thus better prepares them for emergencies. It supplies the best substitute for personal experience. A railroad man is frequently called on to act in a different capacity to that in which he has been accustomed to officiate, to undertake duties of which he has had no experience. No more experienced man is at hand to aid by his counsel. How much better, then, is it at such a time for a man to have at hand a reliable guide and adviser than to be thrown on his own unaided judgment. Moreover, a servant acquainted with the working of all departments, knowing the why and the wherefore of everything connected with his profession, is more likely to take an interest in his work, is more likely to feel the necessity of obeying all orders, is altogether more valuable than the man who knows of nothing beyond the surface of his desk. Homogeneousness, interchangeableness of his staff is one of the objects at which every manager should aim. But not to the subordinate alone would such a code of instructions be valuable. Every day in my work I am meeting with contradictory instructions and decisions which have at different times emanated from the same authority. It must be so as long as the head of the department has no standard for his guidance. Some roads, with a view to instruct and warn their employes, publish periodically a black-list, giving names of the persons punished during the past interval and the acts for which they were punished. There might be some good result from this were it not that there is in it a repulsive cruelty. Publication of the offender's name hardens his heart and gives rise to a spirit of dissatisfaction. The dryness of the reading, moreover, deters every one but the interested unfortunates from even looking over it. A better plan would be the periodical, say monthly, issue of a paper styled after the name of the road, "The ——— Railroad Gazette;" the readable matter might be composed of—

1. Didactic articles tending to exalt the moral tone of the service, to stimulate the desire for professional knowledge and efficiency.

2. Accounts of accidents and irregularities which occurred since last publication, showing how they might have been prevented, holding up for example the conduct of those who have acted promptly and skillfully, and pointing out for avoidance the errors or neglect of others. In these accounts names should not be mentioned, except in extraordinary cases, and, as far as practicable, personal allusions avoided.

3. Professional statistics.

4. Accounts of provident and other societies fostering a spirit of carefulness and forethought.

5. Excerpts from professional publications of the time.

Filled with such matter, a very readable paper might be made up containing much practical information, such as is found requisite from time to time. It should be made interesting to all the employes of the road by its local references, and should carry with it the weight of a semi-official publication. The effects that might be reasonably expected from such a medium of communication between heads of departments and their subordinates are:

1. A more uniform style of working, shaped after the best model.

2. Increased professional knowledge and greater familiarity with details, *i. e.*, greater efficiency.

3. A high moral tone and an *esprit de corps*.

The expense of such a publication could not be great. The editing would occupy only a part of some officer's time. Articles should be contributed by all the officers. Probably many of the subordinates would give contributions. Attention can be called to any rule or general order that may be found not strictly carried out, and in this there is the great advantage that a semi-official warning does not weaken the order referred to as a repetition of circulars does. When every now and then a circular is repeated and words used such as "this is imperative" or "strict attention is required to this," the force of the rule is weakened; for men see that it is not regularly obeyed or enforced, otherwise repetition would be unnecessary. Familiarity breeds contempt. Such repetitions are a sure sign of a weak administration.

The following is a sample of what might be inserted under caption 2—Accounts of accidents, irregularities, &c.:

"On the 24th of last month, just as the morning express was drawing up at station A, an old gentleman asked the baggageman to check a small box for him to station B. Before the box could be checked the train was moving away from the station, and the old gentleman jumped aboard. The baggageman checked the station number on the box and threw it on the platform of one of the cars, calling out to the brakeman to look after it. The brakeman put the box inside the car *and thought no more of it.* At station B, after the train had left, the old gentleman demanded his box, which was *non est.* He described the box and circumstances under which he had made it over to baggageman at A. Station-master B telegraphed to A, who replied *next day*, saying box had been handed to brakeman, not checked, but marked with station B number. The old man left his address and went home. Station-master B reported circumstances by letter to the Superintendent. After considerable correspondence and delay, the case was put into hands of the company's detective. No clue could be found as to the whereabouts of the box. The car in which the brakeman had put it was a through one, running over a connecting road. The company was compelled to settle the claim for $150. Three weeks after the payment the box turned up at a station on the connecting road, and on examination was found to contain some old clothes and rubbish not worth $20. Now let us trace the mistakes and neglect that cost the company $150.

"1. Baggageman at station A should have refused to check the box by that train unless the passenger took upon himself the risk. When the box had been put on the train, as it was, a telegram should have been sent to the next station advising train baggageman to look after it.

"2. Brakeman should have handed box over to train baggageman.

"3. Station A should have replied at once to B's message, instead of waiting until next day. Had B received particulars in time he might have telegraphed to conductor or terminal station, and so recovered the box.

"4. Station-master B, before letting the old man leave his station, should have obtained a list of contents of box and value fixed by the old man. Had this been done while there was every probability of the box's being found, the old man would not have ventured to state a false value, and the company would not have been swindled out of over $100.

"Here we have a very simple case, in which no less than four errors occurred from want of thought, each error in itself apparently trivial, yet had it been avoided all the vexation and loss that followed would also have been avoided. We trust that all those engaged in handling baggage and freight will learn from this the lesson that too great attention cannot be given to their duties, and that they should always be on the alert to adopt precautions when any departure from the general practice is necessary."

If in such cases as the one mentioned the manager punishes all the parties in fault, either of them might not be guilty of such neglect again; but the very same combination of errors might be committed by a different set of men, and so on any number of times. The experience of the case is confined to the actors, unless a circular is issued. But when the account as above given is published in a paper read by every employe, the experience is communicated to everyone, and the probability of repetition is made very small.

To return to the question, "What system of management is best?" the ideas I have endeavored to elucidate may be summed up as follows:

The managing staff should be marshaled thus:

1. A general manager, supreme.

2. Heads of departments, with defined powers and duties.

3. Executive assistant heads of departments stationed along the road where necessary.

4. Intelligence corps, with no executive power, but ranking with assistant heads.

5. Assistant general manager, having charge of the intelligence corps and attending to the discipline—in fact the teacher—with powers such as the general manager chooses to delegate to him.

Economy in the supervising staff is false, though common. The loss occasioned by neglect and mistakes far exceeds the cost of such supervision as would have prevented it.

[TO BE CONTINUED.]

VARIATION BETWEEN HYDROSTATIC AND STEAM PRESSURE IN BOILERS.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The hydrostatic force is the only force present in applying the water test to ascertain the strength of steam boilers; but if heat be applied to a boiler to generate steam, two constant forces are present:

1. The expansive force of steam;

2. Differential expansion.

Besides these, two inconstant forces:

1. Repulsion of the water from the metal;

2. Dissociation of the water, arising from expulsion of the air by continued ebullition, sometimes make their appearance. If the drift-pin has been used, the damage it has done will be increased by heat. One or more of these forces, combined with the expansive force of steam, become irresistible, and when in operation to that extent detract from the possibility of working steam at the pressure of the previous hydrostatic test. The presence of these additional forces in a steam-boiler is clearly attributable to extraneous causes and not to any destructive but hidden agency inherent in steam. For while no force will rebel at a violation of its laws sooner than steam, yet its controlability in conformity with its laws is not exceeded by that of any other active force. In proof of this, we find that when steam has been generated in one boiler and forced into a second one, it requires a greater steam pressure than water pressure to rupture the one containing steam only, owing to its greater fluidity and elasticity. On comparison of two boilers tested, the one by water pressure and the other by steam forced into it, their conditions will be found to be the same in kind and different only in degree of temperature. Every part of each being of uniform temperature, the force of differential expansion is absent in both. The plates not being heated above 600 degrees—the point of maximum vaporization—the force of repulsion is absent in both; therefore, the only remaining force left is the steam pressure in the one case and water pressure in the other. The behavior of steam isolated in one boiler being identical then with that of water isolated in another, and the two being convertible the one into the other according to temperature, it is presumable that there can be no antagonisms due to their contact and union in the same boiler, engendering these dangerous forces. This inference is fortified by the fact that there is not known an instance, where the forms in which the elements of water present themselves, whether in that of gas, vapor, liquid or solid, manifest any antagonisms the one with the other in any possible combination.

It appears, therefore, that there is known to exist in some boilers illegitimate forces capable of producing all the phenomena of explosions, and it further appears that these forces cannot be present in those boilers possessing uniformity of temperature not exceeding 600 degrees and containing water from which the air has not been expelled.

The question now arises, Can these conditions be permanently maintained in boilers generating steam? No problem in mechanics is more simple: By an application of the law of gravity the water will flow from the cold end of a boiler (in a properly adjusted pipe) to the hot end, and the water in the hot end will flow in the barrel of the boiler to the cold end, thus interchanging places with such rapidity as to insure a temperature substantially if not theoretically uniform. The greater the heat the greater the speed of flow. The constant force of differential expansion being thus practically obviated, it remains to dispose of the inconstant force, repulsion. But there can be no repulsion of the water until the plates are heated above 600 degrees, the point of maximum vaporization, an excess of which degree of heat, it is well known, metal cannot receive while a current of water is flowing over it.

It follows, therefore, that neither differential expansion

nor repulsion can be present in a boiler having longitudinal circulation. The salutary consequences of this action of water in steam boilers are not limited to their immediate safety only, but extend to their cleanliness, economy, efficiency and regularity in generating steam.

The flow of water from the fire-box to the cold end of the boiler will produce a current adequate to sweep into the mud-drum all sediment on the sides and bottom. This mud-drum may be so constructed as to form an eddy, retaining the sediment, while passing the clarified water again to the fire-box.

The efficiency of the steam will be increased by freedom from priming, which is occasioned by the throw of the water into the steam-pipe, in consequence of the conflict between the descending water to take the place of that water which is ascending with the steam from the bottom. But if this conflict is avoided by the return of the water to the bottom of the boiler through a different channel, a more quiet separation and delivery is made of the steam into its pipe leading to the engines, lessening by that much its tendency to prime. The violence of this conflict may be ascertained by measuring the temperature of ebullition at various pressures. In a vacuum it occurs at 98 degrees; at great elevations, as the top of Mount Blanc, at less than 200 degrees, and at ordinary levels of atmospheric pressure at 212 degrees. But in a steam boiler, with a pressure equal to eight or nine atmospheres, the automatic separation of the steam from the water is not only more difficult, but the difficulty is magnified by the multitude of tubes and narrow water-ways through which both the ascending and descending columns of water must travel at the same instant. Hence, when sudden relief from pressure is given by a supply of steam to the engine, the violence of the ascending column must occupy the water-spaces to the exclusion of the descending one, with resulting damage sometimes greater than that of priming. The economy is promoted by the maintenance of that temperature most productive of the greatest amount of steam. This point fluctuates slightly above or below 600 degrees, according to circumstances. As an increase in the temperature of the plates slightly in excess of that figure, say to 800 degrees, will render them nearly eight times less efficient in the generation of steam than at a temperature of 600 degrees, and as the circulation of the water will prevent the possibility of their rise in temperature above that of maximum vaporization, it follows that in so far as this is effected, the circulation of water in a boiler longitudinally contributes to its economy by utilizing a heat which otherwise may become a source of disaster. Again, regularity of steam cannot be maintained in a boiler while a part of the water contained in it (that around the fire-box) is heated excessively, and another part (that in the lower legs and lower part of the barrel) has not attained a temperature above that of fever heat. But by longitudinal circulation, all the water having been brought nearly to one temperature, it is in a condition to yield steam with the greatest regularity.

It is moreover maintained that groovings and corrosions are impossible in a boiler with longitudinal circulation of the water sweeping away the superheated steam, which is their cause.

But the weakest part of a locomotive and that which first gives way is the point of union between the flue-sheet and the flues. The difference in the thickness of their materials exposes them to the greatest strains of contraction from the chill occasioned by opening the furnace doors. The effect is visible in the varying shades of color, like that passing over steel in the act of tempering. But if the heat on the inside is made constant by the rapid circulation of water of uniform temperature, the strain of contraction is in a measure counteracted by diminishing the chill. There being, therefore, no force inherent in steam itself so far unmanageable as to destroy a boiler containing aerated water by sudden violence, or to affect its integrity by gradual deterioration, it appears that the variation between pressures of water and steam in producing these ruptures is due to other disturbing forces whose presence is wholly prevented by longitudinal circulation of the water.

[We are not quite sure what our contributor is trying to prove. If he is attempting to show that a boiler with a good circulation of water is safer than one without, it seems hardly necessary to take so many words to establish that point. We cannot avoid the belief that if the time and thought which has been wasted in elaborating mysterious theories regarding the causes of explosions were exercised in securing good material and workmanship in boilers, more explosions would be prevented by the latter means than have been by the former.

Most of our readers will, we think, require some stronger evidence than that contained in the above article to be convinced that "it requires a greater steam pressure than water pressure to rupture a boiler." Who has tried the experiment, and when and where and how? We want the proof. "Presumable antagonisms" don't answer what we want to know, and "inferences" are oftener wrong than right. In discussing this subject, too, why is it that simple things cannot be called by simple names? Why must such foggy terms as "differential expansion," "dissociation of the water," etc., be introduced? Surely there are enough common English words left to explain what takes place when a boiler blows up. The other day, when Mr. Stevens exploded his old boilers at Sandy Hook *intentionally*, we heard nothing about "gas, vapor, liquid or solid, manifesting any antagonisms," no electrical phenomena or chemical decomposition theories were talked about, but the gentlemen who witnessed the experiments saw plainly that the boilers blew up because they were not strong enough. It was thought, too, that most of the mysterious theories were exploded at the same time; but it seems there are some still left. If Mr. Stevens' boilers had been ruptured accidentally instead of intentionally, no doubt we should have been treated to as many theories to account for the "accidents" as the daily papers gave the public after the Westfield accident. Fortunately, in this case, Mr. Stevens foresaw what would take place, and that a boiler, if subjected to sufficient strain, must inevitably break—a conclusion which somehow the world learns very slowly.—[EDITOR RAILROAD GAZETTE.]

PAPERS ON BRIDGE CONSTRUCTION.

NO. II.—ON MATERIALS (CONTINUED).

Cast Iron.—In regard to the use of cast iron in bridge construction there is great difference of opinion, and when properly applied it has certainly produced some satisfactory results. It must be confessed, however, that the advocates for the use of this material are becoming fewer, while the feeling of security in the use of wrought iron (a feeling shared by the public at large as well as by engineers) is becoming stronger. That this is natural, and not the result of a prejudice, arises from the fact that *rolled iron* shows its defects, or at least shows them as much as it is possible for any material to show them; while, on the other hand, no one feels absolutely sure of a perfect casting, especially when used in the form of long, hollow columns. While top-chords may be admissible in cast iron, few engineers permit the introduction of posts of such material in the web system of a truss, and in many cases tenders for such will not be received. Cast iron in its very nature is a brittle material, and while apparently doing good service, may be dangerously near failure, through its being an imperfect casting. It may have had initial strains through unequal cooling, or as a column it might be thinner on one side than another, or it may be weak through concealed blow holes or cinder. Exercise all possible care in the foundry; there is the *risk* of such contingencies, and they are often so formed that no eye or ear can detect them. It is not enough to instance the number of bridges built with cast iron compressive members; it is not enough to quote tables of resistance and the experiments made upon selected specimens; for the *risk* remains, and no human foresight can remove it. Now where it is possible to avoid *risk*, no matter how slight, it is more than important that it should be done in all structures the safety of which affects human life; and it surely needs no argument to show that this applies to bridge construction more than to any other class of engineering work, if the lives of the many are more important than the lives of the few. Exposed as a bridge is to the shocks and vibrations of passing loads, there are produced effects far different to those produced from a simple static condition—effects impossible to compute, which must be met by experience and a sound judgment. While admitting the immense resistance of cast iron to *direct* compression, it must be remembered that such a condition rarely holds in a truss bridge. There cast iron is used in such long lengths, in proportion to diameters, that failure would take place through *bending* at a point very far below the resistance of the material subjected to direct compression. This bending tendency in a long column must be accompanied by tension on the convex side, a dangerous strain to allow upon such cast iron as is generally used in engineering work. It is true that cast iron has been so manipulated as to show a very high tensile resistance; and Major Rodman's experiments are frequently quoted in illustration. It must be borne in mind, however, that his experiments were made for ordnance purposes, in which the question of cost was of small if any account. Ordnance iron is from very carefully prepared pig metal and undergoes several meltings to increase its tensile strength, and if used in bridge work would nearly bring the cost up to that of an entirely wrought iron bridge.

Another peculiarity of cast iron which must not be lost sight of consists in its *irregular* elasticity, which Mr. Ed. Clarke's experiments in connection with the Britannia tubes fully developed. To make a comparison with wrought iron, it may be stated on the above authority, that wrought iron has a remarkably uniform rate of extending or compressing, as near as may be 1-10,000 of its length for every ton per square inch put upon it up to the point of permanent injury, or about twelve tons per square inch, and it will recover its normal length, on removal of the pressure, nearly if not quite up to this limit. Cast iron, on the other hand, changes its length nearly twice as much for every ton of imposed load, and this change is very irregular, especially after a load of about four tons to the inch is passed. While the above generalizations of the peculiarities of cast iron are sufficient reasons to many engineers for insisting upon the use of wrought iron throughout in bridge constructions, there is no use in denying the fact that cast iron has been used with great success, and produced practically very satisfactory results, and the writer does not recall a single instance of failure from the use of cast iron in a properly proportioned bridge. Some attempt was made by interested parties to charge the failure of the Newark Bay draw-bridge to the cast-iron posts used in its construction. The posts did fail to stop an engine that jumped the track at a fair speed, when it plunged into them; but would wrought iron in that case have answered any better purpose? So far as we are aware, bridges are not usually designed for that sort of traffic. A failure, not because the posts were of cast iron, but from an entirely different cause, occurred some time since in one the Southern States, from the fact that water was allowed to remain in the posts after erection, and an unusual frost taking place one night, all or nearly all the posts were cracked near the base. The water probably entered the posts while being erected during a shower, and was carelessly allowed to remain there.

There are certain forms of construction where it is difficult to avoid the use of cast iron, such as joint boxes, post bearings, and in other close connections, and where it is impossible that any other than a direct compressive strain can arise.

Steel.—The general discussion of material would be incomplete without a few words upon the present introduction and possible future use of steel in bridge building. The production of steel in large masses at a reasonable cost has been a manufacturing success only a very few years, but so great has been that success that it is possible to use steel in shapes and forms almost as varied and massive as those of iron. One of the chief difficulties, and one which has only partially been overcome, has been that of securing uniformity of product and of regulating *precisely* the amount of carbon, so as to produce a reliable product for specific purposes. In the matter of rails, tires, etc., this uniformity has been fairly attained, and possibly so in plates and axles; but in the form of bars or shapes further refinements in manufacture seem to be necessary, which will, no doubt, be attained at no distant day.

Ability to use steel for bridge purposes results in a twofold gain—firstly, cheapness, which can only be gained by a reduction of weight; and secondly, the feasibility of longer spans that would not be practicable in ordinary iron. The discoveries and improvements in the manufacture of steel have followed each other so rapidly during the past ten years that it would be difficult to predict the nearness with which the cost of producing steel may approach to that of wrought iron; but the indications are that this difference will be eventually a very slight one. The term steel must now be looked upon as embracing a widely different meaning from that so long attached to it. It is no longer confined to a material of great strength and elasticity, with little toughness, and capable of being hardened. It means, in modern engineering, fused iron, either pure or mechanically treated, cast into ingot molds, which ingots are heated, and either hammered or rolled into form. This wrought iron, while in fusion, may be so treated by chemical mixtures as to have its hardness controlled and adapted to special purposes. While there are numerous processes claiming to produce these results, that known as the Siemens-Martin process seems to guarantee the most reliable product, from the almost perfect control the workman has over the entire operation. For bridge purposes, steel must of necessity be of a low grade—that is, the iron containing a very small percentage of carbon—or otherwise it is liable to fracture under suddenly applied strains.

In small span bridges there is not much probability of steel superseding iron, from the fact that weight in such structures is very desirable, and also because the practical execution of the work involves always much more material than is theoretically necessary. When, however, a structure becomes so great as to allow of a proportioning of parts in exact conformity with the theoretical conditions and amounts of strain, steel will no doubt play an important part in future engineering works, and particularly in those parts exposed to compressive strains. Bridge links and tension members may be made from homogeneous iron to advantage; but when from such iron carbonized, it is a question whether a false reliance

would not be placed upon them, when it is considered how great is the after exposure to high heat necessary for the forming of eyes or heads. Is it not more than probable that these after operations will burn out the carbon from the bar having to be manipulated, and instead of a brace worth so many pounds per square inch due to the proportion of carbon introduced before casting the ingot, there results a bar of lower value, in proportion to the carbon removed during the shaping of the bar into form. What is known as the "upsetting" process would most certainly destroy any carbon that might be in the bar; for to make it susceptible to impression in a die or mold, it it must be brought to a very high heat. In such a process the homogeneous wrought-iron ingot must be used to produce a result equal to the material in the body of the bar not operated upon.

Used in a proper manner, steel comes admirably into play for very large spans, and we can produce at the present time such steel as to make feasible the erection of bridges which would be out of the question in any other material. It should be fabricated cold, however, and in such shapes as to require no reheating for the purposes of forming. Arches and suspension bridges come under these requirements, neither of which types require other than cold work to form the various parts. For plate-girder bridges, no advantage would arise from using steel plates, for the plates of which they are composed are as thin as advisable in wrought-iron, and therefore no opportunity arises for reducing weight. Such girders of steel would be increased in cost from the fact that all rivet holes would have to be drilled, while in the iron they are very apt to be simply punched. This remark, of course, refers to plates above the lowest grades, since plates made from ingots simply purified, with no carbonizer added before casting, are adapted to flanging, forming and punching like ordinary wrought iron, and exhibit a remarkable toughness. The tests given to the lowest grade plates at Trenton, where the Siemens-Martin process is in successful operation, are as follows: A strip from each plate is bent double cold by sledging, after which it is heated to a bright red heat, plunged into water, and again bent double cold. These plates cannot be hardened, and in the old sense are not steel at all, their advantage over ordinary iron plate being due to perfect homogeneity, and absolute freedom from all welds. Rolling iron from piles is at best but a welding process, and, with the best quality of refined iron, the imperfections of such a process are shown under a heat intense nearly to fusion, when it will separate into elements corresponding to the bars in the original pile.

As the most recent experience in the application of steel in large masses to bridge construction, Captain James B. Eads' report (October, 1871) to the directors of the St. Louis Bridge Company, furnishes much food for reflection. It appears that after careful consideration, based upon experiments and the opinion of the leading steel-makers in this country and in Europe, Captain Eads adopted for the ribs of the proposed arches crucible cast steel, and prepared accordingly the specification published in his report of October, 1870.

The contract for the superstructure was made with the Keystone Bridge Company of Pittsburgh, the most experienced and perhaps the most skilled firm of bridge builders in America. Of course the steel specifications were assumed by them as part of their contract, their faith in the ability to procure it being of necessity based upon the assumption of makers. We learn, however, from Captain Eads' report of last October, that the difficulties of procuring the steel called for have been most discouraging, and the William Butcher Works of Philadelphia, which in turn assumed the responsibility of the steel specifications from the Keystone Company, spent many thousands of dollars in a splendid effort to attain it. The first large forgings attempted were the anchor bolts, nearly six inches in diameter and some thirty feet long. Bolt after bolt failed to reach the standard. New mixtures were tried, and finally, after months of delay and loss, they met success. Similar difficulties were met with when the staves composing the arched ribs were undertaken. Here it is of the utmost importance that the staves should be of equal strength, and with the utmost care it seemed almost impossible to attain this equality. From the *same* mixture the staves would *differ* in their quality, which in all probability arose from the reheating the ingots for forging and welding, thus altering the relations between the carbon and the iron. With such sad experiences in the initial stages of the bridge superstructure, it became almost a necessity to discover some other method of making the steel, which would yield with less skill and caution a uniform product. Carbon steel evidently would not do, and the attention of the steel company was turned to a process that few had heard much about, but which gave ample promise of success. *Chrome steel* has furnished the solution, and the original specifications, so far as requiring carbon steel, have been abandoned accordingly. There seems to be no question about the wonderful uniformity attained by this new material, which is no doubt due to the fact that chromium, being a *metal*, forms an alloy with iron, and having small affinity for oxygen, variations in the amount of heating do not affect it. Its hardness and softness seem to be under perfect control, and it is highly probable that engineers will find in this metal a medium in which they can design works of a magnitude hitherto unattained.

While regretting the costly experience of those concerned in Captain Eads' enterprise, still the beginning had to be made somewhere, and it has been their misfortune rather than their fault to have been the unlucky ones to demonstrate to the profession at large the want of capability of carbon steel for such works, and at the same time introduce a material answering the requirements, and pave the way for greater advances still. The engineering world once before was enlightened through a similar experiment, in the case of the Menai and Conway tubes, which resulted in an unparalleled advance in constructive science. Who knows but what the erection of the St. Louis bridge will form another epoch for a similar advancement? ALF. P. BOLLER, C. E.

New York, January 14.

Slipping on Curves.

WESTFIELD, N. Y., January 30, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Much has been said of late through your columns in reference to slipping on curves; for in this I take the ground that all slippage can and should be disposed of entirely, except on driving-wheels of locomotives. For instance, where wheels are nearly of a uniform size, say 30 inches in diameter with ¾ inch cone, being ¾ in. larger in diameter at the flange than at the outer tread, the wheel on the outer rail makes up to the flange in its large diameter, while on the inner rail it seeks a much smaller circumference; so to every revolution of the wheel the outside wheel gains at least two inches, which in running a mile would make nearly four entire circuits. This would be a very heavy curve, and yet I claim to run without slippage with 4ft. 8½in. gauge. The usual amount of play between the wheels an the rails (1¼ inches), the difference in diameter upon the inner and outer rails, is sufficient without an increase of gauge to make a circuit in running one mile; but if you wish to make two circuits in running the given distance, you must increase your gauge ¾ inch on the curve and you can make four circuits by increasing your gauge. Accordingly by this you will avoid slippage. This is practical, and will make trains less liable to run off the track. The gauge of the road should correspond with the radius of the curve.

WM. CRANDELL.

[What the writer says above might be true if the axles were capable of assuming positions *radial* to the curves; but so long as they are parallel to each other, the cone of the wheels will not of itself carry a car around a curve. Of this any one may satisfy himself by making a model of a truck with the axles parallel and the two wheels on one side of larger diameter than on those of the other. Such a model, if rolled on a flat surface, will not roll in a curve, but if the axles are placed radial to each other it will. —EDITOR RAILROAD GAZETTE.]

Skidding of Railway Wheels.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your correspondent "Hiawatha" asks for an explanation of the fact that when the brakes are applied to the wheels of railway vehicles so forcibly as to cause them to skid on the rails less retarding effect is produced upon the train than when a less pressure is applied which just allows them to revolve, and intimates that this would appear to show that there was less friction on a small surface than on a larger one under the same weight.

The explanation is to be found in two laws of friction: the first, that the *friction of rest* is greater than the *friction of motion;* and the second, that the friction of motion decreases in a certain ratio as the velocity of the sliding bodies increases.

Now, so long as the car wheels continue to revolve, their surfaces are *at rest* with regard to the rail, and consequently a greater pressure than the weight bearing on the wheel may be applied to the brake (which acts upon the wheel by *friction of motion*) without skidding the wheels. But so soon as skidding commences, the friction between the wheels and rails becomes that *of motion* at a considerable velocity under the weight merely that bears on the wheel, and hence is less than that which can be applied by the brake so long as the wheel continues to revolve or is *at rest* with regard to the rail.

FRED. J. SLADE.

Trenton, N. J., February 6.

ELECTIONS AND APPOINTMENTS.

—At the meeting of the Trustees of the Atlantic & Pacific Telegraph Company, held in New York on the 2d inst., the following officers were elected: John Duff, President; W. H. Guion, Vice President; E. D. L. Sweet, Executive Manager; George Bliss, Treasurer; Alfred Nelson, Secretary. Executive Committee, Sidney Dillon, John H. Mortimer, C. S. Bushnell, L. P. Morton, W. D. Snow, Judge Emott, Oliver Ames. A vote of thanks was passed to Mr. A. F. Wilmarth, the outgoing President.

—By a circular dated February 1, Mr. H. F. Sweetser, General Manager of the Atlantic & Great Western Railroad, announces the appointment of Mr. C. W. Bradley as Superintendent of the Second and Third Divisions and the Franklin Branch of that road. Speaking of the appointment of Mr. Bradley, the Cleveland *Herald* says: Mr. Bradley, although a comparatively young man, has had very large experience in railroad matters, is a practical telegraph operator, and a strict, energetic and thorough business man.

—At the recent annual election of the Sheboygan & Fond du Lac Railroad Company, at Fond du Lac, Hon. T. F. Strong was elected President; A. G. Ruggles, Vice-President and Treasurer; Edwin Slade, Secretary; J. H. Murrel, Chief Engineer.

—The following directors of the Memphis & Paducah Railroad Company were elected at a meeting in Memphis on January 27: John Overton, Jr., D. M. Henning, H. S. McComb, E. Norton, H. S. Rogers, Alfred T. Lacey, W. F. Norton, J. M. Ryan and L. S. Trimble. E. Norton was elected President. Of the new directory Messrs. E. Norton, W. F. Norton and L. S. Trimble were members of the old Paducah & Gulf board, and Messrs. McComb and Lacey of the Mississippi River Company.

—Officers of the London & Port Stanley Railway Company for 1872 were elected at a recent meeting of directors, as follows: President, Ald. Egan, of London; Vice-President, Ald. Barker; Secretary, Wm. Bowman.

—At the meeting of the Northern Transportation Company on the 15th ult., the following directors were chosen: Gov. J. Gregory Smith and Hon. Worthington C. Smith, M. C., of Vermont; Gov. Onslow Stearns, of New Hampshire; Philo Chamberlain, of Ohio; Hon. Josiah G. Abbott, Gen. George Stark and Benjamin P. Cheney, of Boston, Massachusetts. The directors met in Boston on the 24th of January and elected the following officers: President, Worthington C. Smith, St. Albans, Vt.; Vice-President, Russell Pelton, Cleveland; Secretary, Edwin D. Childs, Cleveland; Treasurer, Horace B. Wilbur, Boston. Mr. Philo Chamberlain, of Cleveland, for twenty years the manager of the company's line, has withdrawn from the company, and Mr. E. D. Childs, the Secretary, is to act hereafter as Superintendent and Manager.

—The city of Philadelphia has chosen as its representatives in the North Pennsylvania Railroad Company, Jacob Riegel and O. Howard Wilson.

—W. H. Lippincott, J. Alexander Simpson and John Noblit have been chosen as the representatives of the city of Philadelphia in the directory of the Philadelphia & Erie Railroad Company.

—The Peninsular Railroad Company of Michigan, at its recent election, chose the following directors: Joseph M. Ward, L. D. Dibble, Wm. Wallace, Battle Creek; S. T. Reed, Cassopolis; M. S. Brackett, Bellevue; Moses Butterworth, Samuel I. Anthony, Valparaiso, Ind.; Wm. Miller, South Bend; Dr. C. V. Dyer, Chicago. With one exception this is the same as the old board. The officers subsequently elected by the Board of Directors are: L. D. Dibble, President; C. Wakelee, Treasurer; M. S. Brackett, Secretary and Attorney; C. P. Miller, General Superintendent and Chief Engineer. W. H. Hollister is General Freight and Passenger Agent of the road, and Thomas G. Templeton is Master Mechanic.

—Mr. John McGee, recently an engineer on the Indiana North & South Railroad, has received an appointment on one of the Peru railroads which Mr. Henry Meiggs is building, and sailed for Lima, *via* Panama, on the 2d inst.

—A circular from A. Mitchell, General Superintendent of the Illinois Central Railroad, announces the appointment on the 1st inst. of Mr. E. T. Jeffery to be Assistant Superintendent of Machinery of that road. Mr. Jeffery, who is still a young man, went into the Weldon shops as office boy some twelve or fourteen years ago, and this appointment indicates how thoroughly he has mastered his business and won the approval of his employers.

—Mr. W. H. Purdy, late Assistant Superintendent of Machinery of the Illinois Central Railroad, with which he has been connected about fifteen years, has accepted an appointment as Master Mechanic of the Indianapolis & Chicago Division of the Pittsburgh, Cincinnati & St. Louis Railway, with headquarters at Logansport, Ind. On leaving the Illinois Central, Mr. Purdy's associates in the employ of that company presented him with a gold watch and a 5-20 United States bond for $1,000—pretty solid testimonials of their esteem for the man who had served with them so long.

—The election of the Worcester & Nashua Railroad Company in Boston, January 25, resulted as follows:

Directors, Francis H. Kinnicutt, of Worcester; Stephen Salisbury, of Worcester; Jacob Fisher, of Lancaster; Thomas Chase, of Nashua; Asa F. Lawrence, of Groton; Francis H. Dewey, of Worcester; Alexander H. Bullock, of Worcester; Calvin B. Hill, of Nashua, and J. Edwin Smith, of Barre, all re-elected.

At a subsequent meeting of the directors Mr. F. H. Kinnicutt was re-elected President and Mr. T. W. Hammond Clerk and Treasurer.

—M. J. Becker has been appointed Chief Engineer of the Pittsburgh, Wheeling & Kentucky Railroad. C. D. Hubbard and Col. James McCluney, of Wheeling, have been chosen directors of the company to fill vacancies.

—At the annual meeting of the Cleveland & Mahoning Railroad Company in Cleveland, on the 25th ult., the following officers and directors were elected: President,

Joseph Perkins; Secretary and Treasurer, Chas. Pease; Directors, Joseph Perkins, Cleveland; Frederick Kinsman, Charles Smith, H. B. Perkins, Warren; Reuben Hitchcock, Painesville; Dudley Baldwin, John Tod, Cleveland; James Magee, Philadelphia; R. W. Cunningham, New Castle, Pa.—all re-elected.

—Mr. E. Q. Sewall, a New England man, but recently General Superintendent of the New Orleans, Jackson & Great Northern Railroad, has been appointed Superintendent of the St. Paul & Pacific Railroad in place of F. R. Delano, resigned.

—There is a report that J. Gregory Smith will soon make way for W. G. Morehead, of Philadelphia, in the presidency of the Northern Pacific.

—At the recent meeting of the Indiana North & South Railway Company, the following persons were elected directors for the ensuing year: Hon. S. F. Maxwell and James M. Nichols, Rockville, Ind.; Hon. J. D. McDonald, Attica, Ind.; Wm. Mathers, New Albany, Ind.; Edgar B. Thomas, Cincinnati, Ohio; J. A. Minnick, Worthington, Ind.; Chas. F. Hopkins, Newburgh, Ind.; Enos Miles, Bowling Green, Ind.; J. G. Ackelmier, Brazil, Ind.; John Saltmarsh, Washington, Ind.; John H. Page, Jr., Pittsburgh, Penn.; M. H. Shryer, Bloomfield, Ind.; L. J. Miller, Booneville, Ind. The board afterward re-elected Edgar B. Thomas, President; Hon. J. D. McDonald, Vice-President; David Cluster, Secretary; D. J. Fuller, Treasurer, holding over.

On the same day Assistant General Manager J. D. Layng issued this order:

"J. D. Ellison, Esq., has been appointed Superintendent of the Little Miami Division, with his office in Cincinnati. Appointment to take effect 1st February."

Mr. Ellison has been for some time Superintendent of the Indianapolis & Vincennes Railroad.

Also on the same date W. G. Brownson, Superintendent of the Pittsburgh & Columbus Division, published the following announcement:

"E. Pierce, Esq., has been appointed Master Mechanic Pittsburgh & Columbus Division of Pittsburgh, Cincinnati & St. Louis Railway, vice Thos. Denmead, Esq., resigned. Appointment to take effect February 1."

—Several changes in the Pittsburgh, Cincinnati & St. Louis Railway are announced in general orders, as follows: General Manager J. N. McCullough, under date of January 29, issued the following:

"John Durand, Esq., having resigned the position of General Superintendent Pittsburgh & Cincinnati Division, until further orders the duties will, on their respective divisions, devolve upon the division superintendents, subject to the instructions of the General and Assistant General Manager."

Report of the Baltimore & Ohio Railroad Company.

This company owns or leases the following lines and branches:

	Miles.
Baltimore to Wheeling	379½
Grafton to Parkersburg	103½
Relay to Washington	30
Harper's Ferry to Strasburg	51
Weverton to Hagerstown	24
Wheeling to Columbus	134
Newark to Sandusky	116
Wheeling to Washington, Pa	32
Total	870

It has a controlling interest in (but does not operate) the Pittsburgh & Connellsville Railroad, 146 miles, and the Marietta & Cincinnati Railroad, 205 miles; and has nearly completed a branch from Point of Rock (69 miles west of Baltimore) southeast to Washington, D. C., 42 miles.

The forty-fifth annual report, giving a statement of the company's affairs for the year ending September 30, 1871, gives the following account of earnings and expenses:

"The aggregate earnings, working expenses and net results of the main stem, including the Winchester & Potomac, the Washington County, and the Winchester & Strasburg branches; of the Washington Branch and Parkersburg Branch Railroads; of the Central Ohio and the Lake Erie Divisions, for the fiscal year, and of the Wheeling, Pittsburgh & Baltimore (formerly the Hempfield) Railroad, for five months ended 30th September, 1871, were, viz.:

	Earnings.	Expenses.	Net Earnin's
Main stem, including the Winchester & Potomac, the Washington County and the Winchester & Strasburgh branches	$9,913,390 49	$5,906,887 68	$4,006,502 81
Washington branch	427,579 42	163,411 05	264,168 37
Parkersburg branch	733,095 34	721,288 02	11,807 31
Central Ohio Division	946,246 15	751,643 91	194,002 24
Lake Erie Division	513,768 51	415,911 49	97,857 02
Wheeling, Pittsburgh & Baltimore Railroad, from May 1, 1871	23,449 51	39,032 99	
Total	$12,557,529 42	$7,998,175 15	$4,574,937 75
Deduct deficit on Wheeling, Pittsburgh & Baltimore Railroad			15,583 48
Net result			$4,559,354 27

"The total amount of revenues compared with the preceding year is:

1871	$12,557,529 42
1870	10,840,370 48
Increase	$1,717,158 94

"The net revenue of the main stem and branches, including the Central Ohio and Lake Erie divisions, and the Wheeling, Pittsburgh & Baltimore Railroad, is thus shown to be $4,559,354.27. The aggregate working expenses were 63 69-100 per cent. of the whole gross revenues.

"During the year 358,046 new cross ties, 10,683 tons of iron and 7,236 tons of steel rails were used in repairing the tracks of the main stem.

"During the year 11 first-class engines, 19 palace and passenger cars, and 944 iron coal hoppers and cars for general tonnage were built at the company's works. Of these cars, 120 replaced that number broken and worn out. The cost of the new and additional equipment, $702,591.95, is charged to rolling power. The equipment upon the main stem and branches consists of 375 locomotives, 254 passenger and baggage cars, and 6,834 eight-wheel house, stock and other cars.

"It is shown that the earnings, in comparison with the fiscal year 1870, have increased $1,485,662.33, and the working expenses $453,427.68, making a comparative increase in the net profits of $1,032,234.65. Compared with the fiscal year 1869, the increase of earnings being $1,188,474.75, and of working expenses $150,781.22; the increase of net profits amounts to $1,037,693.53."

The President recites the history of the steamship line between Baltimore and Liverpool established by this company in 1865. The four steamers made 58 trips, and were maintained at a loss, partly, the President reports, because of their too limited carrying capacity. He believes, however, that they prepared the way for the other European lines now running to Baltimore and indirectly largely increased the revenues of the company.

"It will be seen by the profit and loss account that the surplus fund which represents capital derived from earnings invested in the various branch and connecting roads, and the great improvements which have been continuously constructed on the main line, and which is not represented by stock or bonds, now amounts to $23,246,732.33.

"It is shown by the report of the transportation department that 1,077,649 barrels of flour were brought to Baltimore during the fiscal year, being an increase of 137,259 barrels. A large expansion of tonnage of through merchandise, East and West, is also shown, viz.: from 286,835 tons in the preceding year, to 435,207 tons. The traffic in live stock and lumber has also largely increased.

"The coal trade exhibits a most gratifying increase, viz., from 1,219,638 tons in 1870, to 1,591,602 in 1871, exclusive of 326,880 tons for the company's supply. The policy adopted for the development of this trade has accomplished the important results anticipated. It was determined to establish and maintain low and *uniform* rates, so that consumers could rely upon their supplies being furnished throughout the year at prices which would not be affected by changes in the charge for transportation. The tariff of the Baltimore & Ohio road for coal has continued, summer and winter, without alteration, since March 16, 1868. During this period the prices of anthracite coals have varied largely, caused by strikes in the mining regions of Pennsylvania and frequent changes in the charges for transportation. The Baltimore & Ohio Company refused all propositions for combinations to obtain advanced rates. In view of the excellent quality of the semi-bituminous coals of the Alleghany regions, and the confidence established by the Baltimore & Ohio Company through a steady adherence to its policy, large consumers in New England, New York and elsewhere have been enabled to secure their supplies at satisfactory prices, and have gradually substituted these coals for the other descriptions formerly used. Two hundred iron hoppers, each of ten tons' capacity, have been built for the coal traffic during the past year.

"As it is believed this important trade can be continuously enlarged, additional equipment will be constructed in order to meet the largest requirements for the manufacturing, steamship and other interests.

"The great bridge over the Ohio River, which connects the Parkersburg Branch with the Marietta & Cincinnati road, was completed and opened for traffic on the 7th day of January, 1871. The equally superior structure connecting the main stem with the Central Ohio road, at Bellaire, was completed on the 21st day of June, 1871. The cost of these bridges was $2,337,156.80.

"The Pittsburgh & Connellsville road, now known as the Pittsburgh, Washington & Baltimore Railroad, was opened for business in May last. The developments of its trade are large, and demand a rapid increase of plant. The road is being supplied with additional locomotives and cars, and it is believed that the sanguine expectations entertained regarding the results of that important line, will be ultimately realized. Arrangements are progressing for the extension of this road through Pittsburgh to the great Northwest. It is expected that the construction of the Baltimore, Pittsburgh & Chicago Railroad, fraught as the enterprise will be with such vast advantages to all the extensive and varied interests with which it is to be connected, will be readily effected."

The Treasurer's report shows the amount of common stock to be $13,143,100; stock script not funded, $8,862; preferred 6 per cent. stock, $3,529,800: loans and bonds less sinking funds, $11,186,185.33. Unclaimed dues, the Washington Branch and $23,246,732.33 of "profit and loss" make up the debtor side of the capital account to $51,643,715. On the creditor side the cost of roads, rolling stock, real estate and the great Ohio bridges make up the amount of $35,131,615, and the balance is made chiefly by the stocks and bonds of other railroad companies.

The reports of the Master of Transportation and Master of Road are admirably complete and full, enabling the shareholder to ascertain exactly the items of expenses of operation and maintenance, and the sources of traffic. The report of the Master of Machinery is also unusually full and complete.

Financial Condition of English Railroads.

At last a new year opens with comfortable prospects for a large and long suffering class of people—the railway shareholders of this kingdom. Five years ago the depression of their property was terrible, and, indeed, up to the present time they have rarely received anything like the profits originally anticipated for these wonderful investments. Perhaps the reader may ask why such speculations should be thought more wonderful than any other, and to this question we might concisely reply by quoting certain figures just published by the Board of Trade, were it not that bare ciphers occasionally fail in producing a due impression of the facts they convey. To be sure, nine figures in a row ought to mean something, and it must be obvious at a glance that £529,908,673 is a good deal of money. We doubt, however, whether the whole truth would be realized without further explanation, especially as there is more to be added. The sum just stated represents the amount of money spent in furnishing these islands with the system of railway communication we now enjoy, but the account is only made up to the end of the year 1870, and, moreover, it expresses only the "paid-up" capital, to the exclusion of the further amount which the companies are authorized to raise. Allowing for additions thus suggested, we shall find that on this first day of the year 1872 a sum of at least £600,000,000 stands invested in the railway property of the United Kingdom. Now, if illustration is necessary to explain the magnitude of this amount, we need only observe that it is as much as the Americans borrowed for the charges of their civil war, and three times as much as France has covenanted to pay to Germany.

The returns before us, however, disclose, as we have intimated above, another remarkable fact. In 1849, when the total paid-up capital was about £230,000,000, the total revenue was under £12,000,000; but in 1870, whereas the capital, as we have said, stood at some £530,000,000, the revenue had risen to £45,000,000. In other words, the receipts were more than quadrupled, while the capital employed in earning them was not much more than doubled. It seems, moreover, to be anticipated with confidence that the comparison would be still more in favor of the property in question if the account could be presented up to the close of last year, and, what is even more to the purpose, the ordinary shareholders or proprietors of these undertakings are at length getting the advantage of the improvement. On former occasions we have explained in some detail the curious conditions governing the distribution of railway profits. The fact is, there never was a time when railways failed to earn money, but the money earned was carried off by claimants whose reserved rights took precedence of ordinary dues. Profits cannot be reckoned till debts are paid, and railway companies were in debt everywhere. After raising and expending their original share capital, they wanted more, and raised it accordingly on "preferential" terms—that is, by giving the new shareholders a prior-title dividend. Still they wanted more, and then they went into the market and borrowed money on their bonds or "debentures"—obligations which took precedence of both preferential shares and ordinary shares alike. Consequently, at the half-yearly meetings or audits, when the profits of the six months were produced for division, the distributors had to pay first the debenture-holders, and then the preferential shareholders; nor was it until these classes had been satisfied that a remnant became available for distribution among the original proprietors of the concern. To show the singular proportions of the several amounts, we may say that of a total capital of more than £500,000,000 returned in 1869, less than one-half, or about £226,000,000, represented money originally subscribed. All the rest had been raised on preferential terms; so that the companies had to find interest on a sum exceeding their original capitals before they could reach any profit actually their own.

Nevertheless, they enjoyed all this while a certain advantage, which, though long dormant, has made itself felt at last. Preferential claims, whether in the shape of debentures or shares, were claims for fixed amounts. They enjoyed precedence, but they had no chances of expansion. However rich the company might grow, these special claimants had only their stipulated interest to expect, and not a farthing beyond; whereas the original shareholders were in the position of residuary legatees, and might gain without limit when once the dues entitled to priority had been punctually discharged. That is what has happened now. All the recent increase of railway traffic has gone to the account of the ordinary proprietors. The preferential claimants only get what they got five years ago. though in some cases, it must be admitted, with considerably greater certainty; but ordinary shareholders, instead of receiving a scanty dividend, now receive on the best lines six, seven, or even eight per cent., so greatly has their position been improved. The secret of this improvement is twofold—more business and less extravagance. Increase of custom was pretty sure to come, but it has come this time without any revival of that reckless prodigality which ruined the shareholders of former days. For the most part, though not without notable exceptions still, railway companies have now ceased to spend their incomes in endeavoring to cut each other's throats. In some instances they have even gone a step beyond this state of truce, and are more than half disposed to swear eternal friendship and sign articles of perpetual alliance. Their property is still heavily mortgaged, but an improved rental judiciously economized suffices to pay the interest on the mortgages and leave a handsome surplus after all. In this respect, indeed, there is one more feature deserving notice in recent railway accounts. Debenture bonds are being converted rapidly into debenture stocks—a process which indicates that the obligations represented are now accepted as perpetual. At first we may imagine that money borrowed on debenture bonds was borrowed only for a time, and not regarded as a permanent addition to the stock or capital of the concern. In fact these bonds were usually for short dates, though it was also usually found convenient to renew them instead of liquidating them when the time for payment arrived. Such conditions of finance were discovered in the panic of five years since to be exceedingly embarrassing. At a moment of pressure it was found impracticable to raise money by new bonds for the liquidation of bonds matured, and it was by the presentation of these bonds for payment under such untoward circumstances that certain companies were brought into serious difficulties. Against the recurrence of these difficulties provision has now been made by the conversion of debenture bonds into debenture stock. In other words, capital formerly standing in temporary obligations is now made to stand in a perpetual stock, carrying no liability beyond the payment of interest. The security to the holder is precisely the same, the only difference between the two forms of property being this: that a debenture bondholder could reclaim his capital from the company at the expiration of a fixed period, whereas a debenture stockholder can only realize his investment by going into the open market with his property and selling it at the price of the day. The result is that the companies escape a liability to periodical calls which might again be found inconvenient, but accept a permanent burden to the extent of the stock inscribed. That they acted wisely in this decision the present state of things appears certainly to show. The payments involved are made without difficulty, the surplus remaining supplies handsome dividends, and in the meantime the companies are relieved of what under possible circumstances might prove a troublesome responsibility.—*London Times.*

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Editorial Announcements.

Address.—The RAILROAD GAZETTE *will be printed for the present in New York; our printing house in Chicago having been destroyed. All communications, therefore, whether editorial or business, should be directed to the New York office. The proprietor will receive subscriptions and advertisements at his office in Chicago, Nos.* 63 *and* 65 *South Canal street, but letters should be addressed to New York.*

Correspondence.—We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

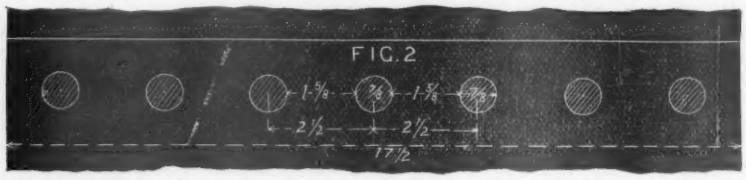
Inventions.—No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

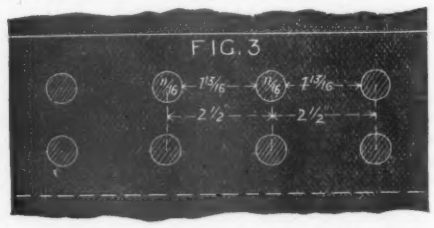
BOILER SEAMS.

In previous numbers of the GAZETTE (August 12 and January 13) the superiority of drilled over punched holes in boiler plates was discussed. In those articles we endeavored to show that a single-riveted seam made with drilled holes might be made 44 per cent. stronger than ordinary riveting with punched plates. This difference in strength is partly attributable to the injury done to the plate by punching, and partly to the fact that drilled holes would coincide better with each other than they will when punched in the ordinary way, and therefore rivets would fit more perfectly and the holes be less liable to leak. For this reason they can be spaced farther apart, and by increasing their diameter slightly their sectional area will be sufficiently great to equal that of the metal left between the holes. To illustrate more fully what we did not perhaps make quite clear to some of our readers before, we will suppose we have a boiler seam formed of plates $\frac{5}{8}$in. thick, and with rivets $\frac{5}{8}$in. in diameter and spaced $1\frac{1}{2}$in.

from center to center, as shown in fig. 1. In the length represented—17½in.—there are ten spaces between the holes, each 1½in. long, so that the sectional area between the holes of one plate amounts to 4.2 square inches. As there are ten rivets, each $\frac{5}{8}$ inch in diameter, their sectional area is 3 square inches. A seam with the rivets $\frac{7}{8}$ inches in diameter and spaced $2\frac{1}{2}$ inches apart, as shown in fig. 2, would have 4.26 square inches area between the holes and 4.2 inches sectional area of rivets in the same length of seam as that shown in fig. 1, or 17½ inches. It will be seen, then, that by increasing the distance between rivets from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches and the diameter of the rivets from $\frac{5}{8}$ to $\frac{7}{8}$ inch, the sectional area of the plate left between the holes is increased about 1½ per cent. and that of the rivets over 50 per cent. Now the strength of a rivet per square inch to resist shearing is just about the same as that of a good boiler plate to resist tearing. It has, however, been frequently shown by experiment that the portion of a boiler plate left between rivet



holes after being punched has been deteriorated, and that its strength has been decreased about 30 per cent. For this reason the sectional area of the plates left between the holes of a punched plate should be 30 per cent. greater than that of the rivets. This is about the proportion in the seam shown by fig. 1. If holes are drilled instead of being punched the plates will not be injured, but will retain nearly or quite all of their original strength, and therefore the sectional area remaining between the holes which have been drilled should be the same as that of the rivets, which, as has been shown, is the case in the seam represented by fig. 2. If, therefore, the seam can be kept water and steam tight with rivets spaced as far apart as $2\frac{1}{2}$ inches, by doing so and drilling the holes it can be made nearly 40 per cent. stronger than that shown in fig. 1. It has been shown in a previous article that holes which are drilled in position must always coincide exactly, and that, therefore, rivets will fit perfectly, and for that reason are less liable to leak, and will also hold the plates together more firmly than they do when the holes are punched. For this reason we think rivets fitted into drilled holes may be spaced farther apart than they can be in punched plates. This is an important advantage, because a larger proportion of the plate is thus left between the holes, and by increasing the diameter of the rivets their sectional area will be equal to it. The reason of this is that the area of rivets increases as the *square of the diameter*, whereas that of the plates increases only *as the distance between the holes.* A given increase to the diameter of the rivets will therefore increase their sectional area much more than the material of the plates will be cut away by enlarging the holes. To illustrate this, suppose the holes for the seam represented by fig. 1 had been drilled instead of punched. As the metal left between them would then be as strong per square inch as the rivets, the sectional area of each should be the same. As that between the holes is now 4.2 and the rivets only 3 square inches, therefore the latter must be increased in size to



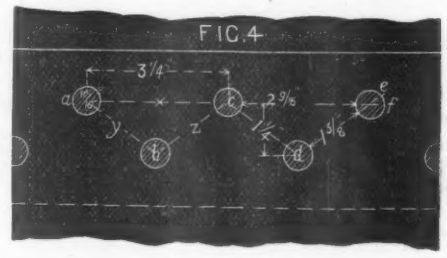
be equal in strength to a drilled plate. If they are made $1\frac{1}{16}$ inches in diameter, they will have very nearly the same strength of the metal between the holes, if the pitch remains the same. By doing so, however, only about 60¾ per cent. of the original plate will remain between the holes, instead of 65 as in the seam shown by fig. 2, in which the rivets are $\frac{7}{8}$ inches in diameter and spaced $2\frac{1}{2}$ inches. Of course this relation of the sectional area of plates and rivets could be stated mathematically, but we prefer to make it clear by the illustration alone, leaving it to each person to apply the principle as occasion may require.

We have been somewhat explicit about this point, because the distance apart of the rivets has an important bearing where double-riveted seams are used. The advantage which the latter possess over single-riveted seams is that the strain is distributed among more rivets, and therefore they may be smaller and consequently less material cut out of the plates for the holes. As an example, take the seam represented by fig. 3 and compare it with fig. 2. In the first 65 per cent. of the plate is left between the holes, while in the latter the strain will be borne by both rows of rivets, and therefore they are reduced in size, and consequently 72 per cent. of the metal is left between the holes.

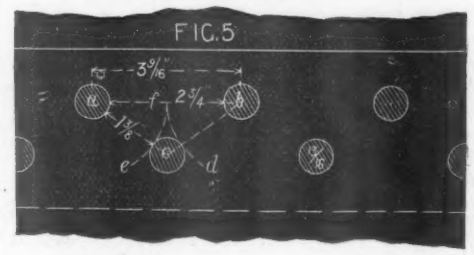
The objection, as stated before, to spacing the rivets very far apart is, that the seams are liable to leak between the rivet holes. In other words, the plates are not held together tight enough to prevent the forcing of water and steam between them. The greatest distance that rivets may be spaced apart without incurring danger of leakage between the plates must, however, be determined more by practical than theoretical considerations. What we wish here to make clear is, that a boiler seam will be stronger if the diameter and distance apart of the rivets is increased in the proper proportion to each other.

In doing this much advantage is gained in double-riveted seams by placing the holes in the two rows alternately to each other, or spacing them "zig-zag," as shown in fig. 4, which represents the proportions of the double-riveted seams used by Mr. Chapman, of the Cleveland & Pittsburgh Railroad. It will be seen that the rivets in the adjoining rows are much nearer together than those in the same row, but the sectional area of a plate in this line *a, b, c, d, e* is over two square inches, whereas, in the line *a, f,* it is only 1.7. Therefore, although the rivets on the zig zag line are nearer together than those in the same row, yet the former line offers more material to resist rupture. The strongest seam of this kind will be one in which the material between the rivet holes—say *a, c*—in the same line is equal to two of the spaces between the rivets in adjoining lines. Or, to express it algebraically and supposing x to represent the distance between the circumference of the holes a and c and y, and z equal to that between a and b, and b and c, then we ought to have $x = y \times z$.

In order to make the strongest double-riveted seam of this kind, we must, therefore, first determine upon the



greatest distance which is admissible between the holes in order to keep the boiler tight. Supposing that this distance be $1\frac{3}{8}$ inches, as shown in fig. 4, then the space between the holes on the *same line* should be $2\frac{3}{4}$ inches. If the plates are drilled, the sectional area of the rivets should be equal to that of the plates between the holes. As there are two rivets to resist the strain due to the space between the adjoining rivets, as *a, c,* for example, therefore the sectional area of each one of them should be just half that of the plate between the holes *a, c.* With a $\frac{3}{8}$-inch plate this latter area would be 1.03 square inches, the half of which would correspond very nearly with the area of $1\frac{3}{16}$-in. rivet. Having the distance between the rivet holes on the same line and the diameter of the rivets, it is of course easy to establish their pitch, which would be in this case $3\frac{9}{16}$, as represented in fig. 5. It now



only remains to establish the position of the rivet *c* in the adjoining line. This can easily be done by taking a radius, *a f,* equal to one-half the distance between the centers of the rivets, and from them describing two arcs, *f, c* and *f, d.* If now the hole *c* be located so as to be tangent to these two arcs, then the spaces between the holes, *a, c* and *c, b,* will be just equal to that between *a* and *b.* The plates will, therefore, have the same strength in the line *a, c, p* as in *a, p.* The center of the rivet *c* can be fixed, perhaps, easier by taking half the pitch of *a, p* plus half the diameter of the rivet hole as a radius, and describing from *a* and *b* two intersecting arcs at *c,* which will be the center of the rivet. Having determined the position of these rivets, it is, of course, easy to lay off all the others for any plate. It is not said, of course, that

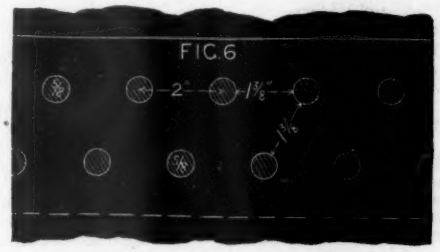
1⅛ inches is the best distance between the rivet holes, but that amount of space is assumed merely to show how to lay off the rivet holes so as to make the strongest seam. That shown by fig. 5 with drilled holes would give over 77 per cent. of the strength of the plate itself.

The following table will show the relative strength of the different seams we have illustrated:

Fig. 1, punched	45	per cent.
Fig. 2, drilled	65	" "
Fig. 3, "	72½	" "
Fig. 4, punched	55	" "
*Fig. 4, drilled	61	" "
Fig. 5, "	77	" "

* The cause of the weakness of this seam is the smallness of the rivets. With ⅝ inch rivets its strength would be over 72 per cent. of that of the plate itself. With punched holes larger rivets would not increase its strength, as the plate would then have less strength between the holes than that of the rivets.

If instead of 1⅛ inches between the holes we fix upon 1¼, then the strength of the seam with rivets ⅝ inches (full) in diameter would be reduced to a little less than 76½ per cent. of that of the plate. That the proportion and relation of the rivets in the boiler seams has a very material influence on their strength will be seen if we take as an example a seam which is very common in ordinary practice, represented by fig. 6, and which has only about 68½ per cent. of the strength of the plate, notwithstanding the fact that none of the rivets are nearer together than 1⅛ inches.



In a future article we will have something to say about double and single welt seams.

THE INDIAN TERRITORY AND THE RAILROADS.

The Indian Territory is an anomaly in the United States. While in the nation and subject to it, yet it forms no part and has no power as member of the confederacy. It is not a territory as other territories are, having no government established by Congress and no officers appointed by the President. The inhabitants have formed their own government, or governments, and made their own laws, and almost the only authority exercised by the general government is that which, in effect, prohibits the immigration of white men into the territory. The people—part of them, at least—are civilized after a fashion, though not exactly after our fashion; they do not subsist solely by hunting; they have many cattle, and some cultivated ground; they have schools and churches, and at least one newspaper; they have also a regular form of government, with officers and courts; they have elections, parties, probably enough primary meetings, possibly "rings." They are reported to have altogether lost the savagery of barbarism which distinguishes the race, and to have become peaceful members of society. But, however far their advance from the savage state, they are yet very unlike the white race which occupies the country north, south and east of them and has some colonies west of them. Their wants are easily satisfied; they do not eagerly pursue wealth, and so make use of and develop to the utmost the resources of the country in which they live. They do not even increase and multiply, and there are few or no immigrants of their own race, while those of our race are forbidden. They buy little and sell little, and the entire imports and exports of the great and fertile territory are hardly so much as those of a petty village in Massachusetts or Iowa.

When the Indians were given this territory, with the assurance, or something like it, that it should be for them and their children forever, that there they would have reservations from which they should not be removed, and which the white man should never be permitted to buy or to occupy, the district was so remote from civilization, and there was such an apparently inexhaustible supply of fertile and desirable land yet unoccupied aside from it, that the probability of its being especially desirable for white settlers, or, in a manner, necessary for the natural development of their traffic, scarcely occurred. Now, however, we see States organized and comparatively populous on its northern, southern and eastern borders, and thousands of men look hungrily at its fair forests and valleys, and long for permission to go in and occupy the land. Two railroad companies have a considerable mileage within its borders, and others are at its borders and eager to extend their lines into or across it. But an arbitrary line separates them from their desire. Immigrants may cross, but they may not acquire lands and homes; the railroads which have authority to cross the territory find only a beautiful wilderness, with an extremely scanty population, which does not increase, and a still scantier traffic, scarcely sufficient to support twenty miles of road. An aggregate population of less than 70,000 does not promise heavy earnings to the 250 miles of the Missouri, Kansas & Texas Railway soon to be completed across it from north to south, or to the 500 miles of the Atlantic & Pacific Railroad which will be within this territory when the line is completed. Evidently, if things remain as they are, the sections of these roads in this territory will be almost a dead weight on their through traffic, adding greatly to their length and scarcely at all to their business.

On the other hand, if what we hear of the character of the country in this territory is true, these lines might reasonably expect from this territory an unusually heavy traffic within a few years, if it should be opened for settlement unreservedly. Already scarcely a desirable, free homestead can be found in Southern Kansas from the Missouri line to the barren plains; and should, the Indian Territory be opened, either to claimants of free homesteads or for sale at the government prices of $1.25 or $2.50 an acre, there would be immediately such a rush of immigrants as was never seen before in this country, except in newly discovered mining regions.

It may be guessed, therefore, that the railroad companies are opposed to the policy of excluding white immigrants from this territory. It stands between them and certain prosperity. Its repeal would in some cases add millions to the value of their property. Its modification even might make lines valuable which otherwise could hardly expect to pay their operating expenses.

There has been recently a meeting in St. Louis, especially in the interest of the Atlantic & Pacific Company, at which speeches were made, letters read and resolutions passed, the import of which was that the Indians should no longer be permitted to stand in the way of civlization and modern improvements, and that in some way the territory should be opened for settlement, especially in order that some inducement might be offered for the extension of the Atlantic & Pacific Railroad across the continent near the thirty-fifth parallel.

At the meeting mention was made of a bill which has been introduced into Congress. This provides for a territorial organization and the reservation of 160 acres of land for each Indian, the remainder to be sold for the benefit of the tribes. The more ambitious of the Indians, it is said, favor such an arrangement, as it would probably make them the richest rural community in the country. A letter from Mr. Henry T. Blow gave the following as his idea of the policy which should be adopted:

1. That national legislation should not longer be deferred, and that all the territories of the United States should be opened to public enterprise, and be made to contribute to the security and comfort of the American people.
2. That the pledged faith of the nation should be preserved toward the Indians, and that as guardian of this territorial property it should not despoil them of a single acre.
3. That if these lands, as in other portions of the territory of the United States, are necessary for railroad purposes, the government should have them fairly valued, and pay the owners the principal, or invest the amount of the same, at their option.
4. That the reservation for each Indian should be most liberal, and the balance of the lands sold to actual settlers only at graded prices under governmental supervision, and for the sole benefit of the Indians.

Another proposal has been made, which perhaps will be more likely to meet the approval of those who believe that the Indians should be kept by themselves and the whites not permitted to settle among them. This is, that a belt fifteen or twenty miles wide on each side of the authorized railroads be opened for settlement and sold at fixed prices, the proceeds to be devoted to the Indians. Thus each road would have a territory on its line sufficient to support it, and there would remain large districts in which the Indians could be kept free from the malign influences which the average frontier-man is supposed to exert, and be free to work out their own salvation. Such a plan, indeed, might suit the existing companies better than an unlimited opening of the territory.

There can be no doubt, of course, of the desirability of some such policy to the railroad companies and the settlers. Whether it would be well for the Indians or not is a question not so easy to decide; and the general voice of the country, no doubt, will be that their interests—that is, the interests of the Indians who have made some progress toward civilization—should be considered first of all. The companies which have built railroads did it with their eyes open and with all the existing limitations, and in the case of one, at least, the bare privilege of crossing the territory was considered a very valuable franchise, worth a severe contest. But if what they now seek is compatible with the true interests of the Indians, there should be no hesitation in granting it.

Discovery of a Great Debt.

We sometimes hear of the discovery of great treasures and the findding of fortunes, but if the discovery of debts of a million or so is a common occurrence it is not thought romantic enough to find currency in the newspapers. But such a case seems recently to have occurred in New England.

The Boston *Advertiser* reports that it has suddenly been made known that the Rutland Railroad Company has a debt, contracted by the trustees of the second-mortgage bondholders, exceeding a million and a quarter in amount, and not provided for by the lease to the Vermont Central. When the lease was made, about two years ago, it was announced and generally believed that the total stock and bonded debt amounted to but $3,000,000, $o,380,000 of stock, bills payable and third-mortgage bonds having been extinguished by a foreclosure under the second mortgage. This view was adopted by the then directors, under whose auspices a pamphlet was published in March of last year, which gave as the total funded debt $1,000,000 represented by equipment bonds, and other claims well established and provided for. This statement gave confidence in the stock of the company, which has been purchased by trustees as well as other investors, and lately sold up to 80.

The remarkable thing is that such a debt was so concealed, and what renders the case worse is that one, at least, of the trustees who incurred the debt, and who, therefore, may be presumed to have known that it existed, signed the very pamphlet which ignored it in giving what was presented as a *full* statement of the company's debts, and that, apparently, with the intention of giving credit to the stock and establishing a demand for it.

The immediate result is that the preferred shareholders will receive their dividends in 6 per cent. scrip, and that bonds not to exceed $1,200,000 in amount are to be issued to meet the debt. The prospect of dividends on the common stock has become very distant, and there is a feeling in New England that not all the sharp financiering is done in New York. However, the stockholders have re-elected all the old directors, as if they at least believed that whatever is wrong is simply a mistake due to forgetfulness, which of course it may be; though trustees who "forget" liabilities of a million and a quarter can hardly be safe men to manage the finances of a railroad company.

Sale of the Cleveland & Mahoning Railroad.

The Atlantic & Great Western Railroad Company has been for some time operating this road, paying a fixed rental which gave the Mahoning stockholders 7 per cent. on their stock. The lessee now, it appears, wishes to become the owner of the property—at least it is assumed that the offer of Mr. James McHenry is made in behalf of the company with which he has been so closely identified. The offer of 20 per cent. premium on 7 per cent. stock seems an exceedingly good one to American investors, being considerably higher than the 7 per cent. bonds of the strongest railroad companies. At this rate the stock of the company will cost $2.468,100 and this with the bonded debt will make the capital account to the new owners $3,642,000, for 90 miles of road, or about $40,500 per mile—a very moderate amount truly, compared with the Atlantic & Great Western's account.

The Cleveland & Mahoning is a good property and especially valuable to the Atlantic & Great Western, which seems to have been located originally with a view to avoid all considerable cities. It cannot, however, be called an extension of that road, and affords only a very indirect connection with that part of the line west of Leavittsburg (224 miles); but it greatly adds to the traffic of the 165 miles of the road east of Leavittsburg, and moreover affords a heavy coal traffic. It is a good property in itself, without reference to its connections, and will grow more valuable as the iron manufactures of Cleveland, now of great importance, increase and demand additional supplies of coal.

The Baltimore & Ohio Report.

The report of the Baltimore & Ohio Railroad Company for the last fiscal year (ending September 30, 1871), shows that the earnings of the 870 miles of railroad operated by that company were $12,557,529, or at the rate of $14,434 per mile, which, considering the extent of the lines and the country in which the roads are—not the most populous, and with comparatively few large towns—is an exceedingly healthy and most creditable exhibit, exceeded only by a few Northern lines. The net earnings are at the rate of $5,240 per mile. Taking the main line from Baltimore to Wheeling, with the branches to Hagerstown and to Strasburg, 455 miles, the earnings are at the rate of $21,788 per mile, which is only $5,000 per mile less than the receipts of the New York Central & Hudson River, with its immense through traffic and the numerous cities on its line, and but $2,500 less than those of the Erie. The earnings of the Parkersburg Branch were only about $7,000 per mile. The earnings of the Washington Branch, which has all the

business from the north and is frequently condemned as an oppressive monopoly, were $14,252 per mile, which is less than the average of the entire system. On this line the passenger traffic forms by far the largest part of the business, earning no less than 77 per cent. of the gross receipts, while on the entire system east of Ohio they are only 17¼ per cent.

The increase in business over the previous year is nearly 14 per cent., and almost entirely in freight, the passenger receipts having increased scarcely 2 per cent.

NEW PUBLICATIONS.

The Chicago Railway Review, burned out like other Chicago journals and people, like the rest of us did not stay burned, and in some way seems to be the better for its scorching. After a sojourn for a time in St. Louis, it has returned to Chicago transformed into a quarto and very handsome sheet of eight six-column pages, making a paper very like the New York *World* or Chicago *Times* in shape and size, but very neatly printed on tinted paper. The first issue in this form was made January 25, and a new volume is dated with that number.

The *Review* gives most of its space to railroad news, and in this particular it excels all other American railroad journals except one, which modesty forbids us to name, and regarding which, very likely, we might naturally be regarded as prejudiced. Its criticisms, to be sure, are apt to be of the "genial" order, and one might get from it the impression that railroad men have few of the imperfections of mortals, and that each railroad is the best; but this is usually an agreeable impression to have, especially if one is the railroad man or interested in the railroad spoken of. Moreover, the *Review* exhibits scholarly writing and painstaking editing, such as, we must confess, are usually conspicuous by their absence in American special journals, many of which seem to have attached themselves to their specialty chiefly as leeches, and to exist by obtaining money on false pretenses, being thrown together rather than edited, and universally unread because altogether unreadable.

One thing in the new *Review*, however, we witness with pain, and that is the engraved head purporting to give a view of the new Chicago at the depot on the lake, and which is likely to create a prejudice, to speak mildly, against the new Chicago, and suggests that it may have been designed by a St. Louis or Cincinnati artist who does not love Chicago.

The Industrial Monthly.—This journal succeeds *The Technologist*, or rather *is The Technologist* with a new name and title-page. The number before us has 34 pages (small quarto) of reading matter and 18 of advertisements, besides a handsome cover. It has great variety of readable articles on subjects connected with mechanics, building, etc., and three handsome full-page plates.

Molesworth's Pocket-Book of Engineering Formulæ.—There are some books which, from long use, produce a sort of feeling of personal friendship. In our own experience Molesworth's Pocket-Book has been one of this kind. We have before us a copy of the sixth edition, which we have used for six or eight years, and also this new copy, which, the title page informs us, is the "seventeenth edition, revised, with considerable additions by the author." The latter produces the impression created by meeting a friend after a long absence. He is the same, yet different. He has usually grown in stature, experience and wisdom. So it is with the new Molesworth. It has increased in size, it contains more information than the old editions, and has evidently improved during the past years. Some useless matter has been eliminated, and all is more conveniently arranged.

This book has the great merit of being very portable, its size being 4¾x3x¾ inches. It is printed on good paper, in distinct, clear type, and can be read with the greatest ease. The algebraic method has been adopted in the calculations, but only the simplest, equations which any one with a slight knowledge of the elements of algebra can solve. After a number of years of use, we have found it to be one of the most convenient and reliable books of reference, and full of useful information for engineers, both civil and mechanical. It contains 440 pages and an admirable index in which some reference is made to nearly all subjects relating to engineering. The price is $2.00 and it can be procured at the New York house of the publishers, Messrs. E. & F. N. Spon, No. 446 Broome street.

Useful Information for Railway Men.—This book was prepared originally by Mr. W. G. Hamilton, as an advertisement for the Ramapo Wheel and Foundry Company, and intended for gratuitous distribution; but the demand for it was so great that the author subsequently prepared a new and enlarged edition for sale. The material being compiled by an American engineer, it of course has more direct reference to railroad practice in this country than the book referred to above. It is also a little more full in some of its descriptions and directions. Some of these, however, have a suspicious look, as if intended as advertisements, such as that of the safety-valve on page 288. Most of the rules and calculations are given arithmetically, although some few formulæ are given algebraically.

The book is more full of data relating to weights, etc., of railroad equipment and rules and regulations of railroad management than any other we know of. It also contains a very large amount of information of an elementary character, and much that is neither mechanics nor engineering, such as antidotes for poison and prescriptions for the cure of diarrhœa and other diseases.

The book is, in fact, what its name indicates, a collection of "useful information for railway men," of which it contains a great deal. It is a little larger than Molesworth, containing 570 pages, and is printed on thinner paper. The typography is not nearly so good as that of Messrs. Spon's book, and the work is defaced by advertisements throughout. We also think that if some of the descriptions of patented devices of doubtful utility were omitted, the size of the book might be considerably diminished without affecting its value or usefulness.

It would be difficult, however, to determine which of the two books referred to in these notices contains the largest amount of valuable information. That of Molesworth is certainly the most systematically arranged and the most legible and easiest for reference; while Hamilton's is more full and the information is given more in detail and is more especially adapted to the wants of American engineers. The latter has, however, the most chaff mixed with the grain, which sometimes disturbs one's intellectual digestion of its contents. Those who have no knowledge at all of algebra will be able to use Hamilton to better advantage than Molesworth; while those who do know a very little of its elements can make their calculations with greater facility from the latter than from the former, which is published by D. Van Nostrand, New York.

General Railroad News.

CHICAGO RAILROAD NEWS.

Chicago Northwestern.

The following statement is made of the gross earnings of the Chicago and Northwestern Railway for the past year:

	1871.	1870.	Decrease.
January	$655,427	$796,024	$140,547
February	602,481	753,782	151,301
March	774,993	858,359	83,366
April	789,641	929,077	139,436
May	1,094,101	1,177,897	83,796
June	952,899	1,139,284	186,384
July	851,846	1,034,392	182,546
August	1,091,337	1,227,512	128,175
September	1,281,574	1,259,282	Inc. 22,292
October	1,047,318	1,306,338	Dec. 259,020
November	1,006,235	1,037,963	31,728
December	842,012	773,494	Inc. 68,518
Total	$10,997,864	$12,293,404	Dec. $1,295,540

The following shows the business of the road for the first six months of the company's fiscal year:

Gross earnings for June, 1871	$952,899 78
Gross earnings for July, 1871	851,846 45
Gross earnings for August, 1871	1,099,337 78
Gross earnings for September, 1871	1,281,574 36
Gross earnings for October, 1871	1,017,318 08
Gross earnings for November, 1871	1,006,235 34
	$6,239,211 79
Operating expenses, taxes, interest on bonds, sinking funds, and rent of leased roads	4,318,673 78
Net income six months	$1,920,538 01
Balance of income account, May 31, 1871	333,559 17
Total income December 1, 1871	$2,254,097 18

Out of which 3½ per cent. has been paid on $20,000,000 preferred stock. A considerable portion of the cash belonging to income has been expended on the Winona & St. Peter's Extension, west of the Mississippi River, and this money will soon be reimbursed to the company out of the proceeds of $4,000,000 land-grant 7 per cent. bonds of the Winona & St. Peter's, just negotiated at Amsterdam at the equivalent of 90 per cent. currency in New York. The above gross earnings of the six months compare as follows with the corresponding months of 1870:

June 1, 1871, to Dec. 1, 1871	$6 239,211
June 1, 1870, to Dec. 1, 1870	7,004,771
Decrease (nearly 11 per cent.)	$765,560

The engineers of the company have recently made a survey for the western part of Madison Extension, from a point near Sparta (on the Milwaukee & St. Paul 25 miles west of La Crosse) westward a little north of the line of the Milwaukee & St. Paul to a connection with the La Crosse, Trempealeau & Prescott road near Onalaska, which is three miles above the junction with the Milwaukee & St. Paul.

Illinois Central.

This company has been issuing excursion tickets from Chicago to New Orleans and return for $39.75, good down until February 10, and good to return until the 25th inst. The occasion is the celebration of Mardi Gras at New Orleans, on the 13th, which is something so strikingly unlike American customs that it attracts great attention.

Chicago, Danville & Vincennes.

This company and the Chicago, Columbus & Indiana Central are asking the city to vacate Depot place, in the West Division, a street extending east and west about five blocks, so as to give them the right of way to that extent into the city. In the Common Council should grant their petition, they will allow one other road to enjoy the right of using the track. The Railroad Committee of the Common Council have not yet agreed upon any report as to the various projects before them, but are obtaining information at meetings held two or three times a week. They will report before a great while, and will recommend some plan that will decidedly favor all new railroads.

Chicago River Traffic.

Mr. J. Gray, Superintendent of the Track Department of the Pittsburgh, Fort Wayne & Chicago Railway, furnishes the following statistics of the business done during the past year by the railroad bridge over the South Branch of the Chicago River: Number of tugs passed, 23,704; vessels passed, 10,328; canal boats, 5,007; propellers, 588. Total, 39,627, against 40,191 for the year 1870. The bridge, in making the requisite number of turns to accommodate the movements of these vessels, swung its ends through a distance of 1,760 miles, while the tenders tramped nearly twelve miles. The number of swings made was 13,647. The bridge opened February 17 and closed December 15.

This bridge is more than three miles from the mouth of the river, and comparatively only a small part of the vessels in the river pass it.

Iowa & Southwestern.

This railroad, it will be remembered, on account of financial difficulties arising in consequence of the Chicago fire, was obliged to suspend work for a time. The road is to connect at Clinton with Oscaloosa by way of Iowa City. In November the contractors suspended work. But the indications are now better; the contractors have resumed work again and are discharging their obligations to the company in full. All arrangements have been perfected for pushing the road forward as soon as spring opens.

Chicago, Dubuque & Minnesota.

An arrangement has been perfected whereby the business of the Chicago, Dubuque & Minnesota road is hereafter to go to Chicago *via* the Chicago & Iowa road, which latter promises rapidly to develop into a first-class line. Of course the route is on the Illinois Central from Dubuque to Forreston.

Chicago & Alton.

This company opened the South Branch on the Missouri Division from Fulton to Mexico, a distance of 27 miles, on the 1st inst.

Milwaukee & St. Paul.

This company is rapidly constructing its road-bed from Milwaukee to this city. What is a little curious is that they have chosen the water-shed between the valleys of the St. Lawrence and the Mississippi for the line of the road, which lies only from three to six miles back from the lake. This location has the double advantage of being the most direct line between Milwaukee and Chicago and also the cheapest and best, since it avoids all streams and ravines, and renders unnecessary the construction of a single bridge. The line will pass about six miles west of Racine and about three west of Kenosha, and is producing quite a little hubbub in those cities. Indeed, it will have scarcely a village on its line, at least in that part of it in Illinois, and that is its weakest point. The Northwestern's line is now lined with pretty towns and villages which afford it the largest part of its local traffic, and which certainly are not going to take their business to stations three or four miles off. On the other hand, the country traffic can reach the old line only by crossing the new one, and doubtless some stations on the new line will ship a considerable amount of produce. But much of this trade will go to the towns, and preferably to the larger towns, and these, as we have said, are all on the old road.

Chicago & La Salle.

The Chicago & La Salle Railroad Company has made a proposition to the Common Council to sink their track 16 feet below the surface of the ground within the city limits, so as to permit its trains to run rapidly in and out of the city without danger to the public. The proposition is that a double track shall be laid and that at least three other railroads shall be admitted to the right of way.

A letter from the City Engineer, Mr. E. S. Chesbrough, shows that that official, who has acquired a world-wide fame as an engineer, believes the project to be feasible. The track will be below the water level, but it is to be along the South Branch, and will be excavated out of a hard clay bed, which is impervious to water, so that the sunken road-bed will need to have machinery for pumping out the rainfall, and but little more. The immediate object of the Chicago & La Salle Railroad Company is to get the means of quick transit between Chicago and Riverside.

Should this project be feasible, it is probable that the plan will be adopted for the Evanston and other suburban roads, thus solving the question of rapid transit between the center of the city and its limits and suburbs. The fire has tended to spread the business of the city over a vast area, an area which will not be likely to contract when the burned portion is rebuilt, but the time now occupied in going from one section of the city to another at the slow rate of the street cars is becoming irksome to the progressive fellows who are taking the business of the city into their hands.

Pittsburgh, Fort Wayne & Chicago.

This company, it is reported, will build a new freight depot 400 feet long, at the corner of Canal and Van Buren streets. It has now one large freight house, but its immense business demands additional accommodations.

PERSONAL.

—Major Robert Emmett, now Eastern Passenger Agent of the Vandalia road, but formerly of the Allentown line and other Eastern railroads, has become as popular in Indianapolis, it seems, as he has been elsewhere; for his friends there tendered him a complimentary benefit at the Academy of Music a short time ago.

—Mr. M. E. Brown, Master Mechanic of the Erie Railway at Buffalo, has been nominated as the Democratic candidate for Mayor of that city.

TRAFFIC AND EARNINGS.

—The traffic receipts of the Grand Trunk of Canada for the week ending January 13 amounted to £33,700, against £30,800 in the corresponding week of last year, showing an increase of £2,900, or 9½ per cent.

—The traffic receipts of the Great Western of Canada for the week ending January 12 amounted to £20,527, against £19,466 in the corresponding week of last year, showing an increase of £1,061, or 5 per cent.

—The gross earnings of the Philadelphia, Wilmington & Baltimore Railroad and leased lines for the year ending October 31, 1871, were at the rate of $11,656 per mile,

while the operating expenses were 67 per cent.; leaving $3,885 per mile as profit per mile on the capital invested.

—The following were the receipts of the Philadelphia & Erie Railroad Company during 1870 and 1871:

Gross receipts for the year 1870	$3,144,044 73
Gross receipts for the year 1871	3,542,263 71
Increase for the year 1871 (12¾ per cent.)	$398,219 02

This is at the rate of $12,215 per mile of road, which is more than is earned by many of our roads paying 10 per cent. dividends. But somehow it seems to cost extravagantly to operate the road, the percentage being about 82 in 1870.

—In the month of December alone postal service was extended to 968 miles of new railroads, on 29 different lines, opened during that month.

OLD AND NEW ROADS.

Cincinnati Southern.

The charter granted by the Kentucky Legislature to the Cincinnati Southern Railroad provides for the survey of one or more routes *via* Nicholasville and Danville, in the direction of Sparta, Tenn., the choice of routes to be made by the people of Cincinnati, and imposes a *per capita* tax of 50 cents on each passenger across the Commonwealth of Kentucky, 25 cents for each passenger traveling 100 miles, and one cent per 100 pounds on through freight. The Cincinnati *Commercial* says of the latter that it is in effect a black-mail demand, and the insolence of it is not less remarkable than its illegality. It does not suppose there are many persons in Kentucky, in or out of the Legislature, who expect the tax to be paid.

The bill, with all the Senate amendments, has passed the House. Some opponents of the measure voted for the amendments, expressing the hope that the people of Cincinnati would reject the charter on account of the amendments. The friends of the bill voted for the amendments, hoping that future legislation would remove the objectionable features of the bill.

The Common Council of Cincinnati has passed resolutions requesting the trustees of the city to refuse the charter.

New York & Naples Steamship Line.

It is reported that Neapolitan merchants will put a line of iron steamers on the route between New York and Naples next fall, with special reference to the trade in Mediterranean fruit. They will touch, probably, at Palermo or Messina, Marseilles and Gibraltar.

Southern Railway Security Company.

The following are given as among the members of this company: B. F. Newcomer, S. C. M. Shoemaker, W. F. Walters, W. F. Walters & Co., Baltimore; J. D. Cameron, George W. Cass, Harrisburg Car Manufacturing Company, John N. Hutcheson, P. A. & T. Small, George Small, Thomas A. Scott, Thomas A. Scott (trustee), A. J. Drexell, H. H. Houston, George W. Harris, S. & W. Welsh, Pensylvania; Joseph Jacques, C. M. McGhee, Tennessee; H. B. Plant, Georgia; William E. Dodge, Jr., William B. Fowle, A. Iselin & Co., D. Willis James, M. K. Jesup & Co., Roosevelt & Son, R. F. Wilson, Robert Lenox Kennedy, John A. Stuart, William H. Fogg, M. White, D. S. Hewett, James Robb, J. J. Michell, Schuchardt & Son, W. Aspinwall, J. L. Aspinwall, E. Colwell, J. D. Phelps, New York; Daniel James, G. Homans, E. H. Green, England.

The capital of the company is given as $5,000,000, and considerable surprise has been expressed at its apparent inadequacy. But the operations of this company, so far, seem limited to leasing and operating railroads, and this is a business which does not require capital, but judgment and skill. The company doubtless intends to make no leases which will not be profitable, and so long as receipts exceed expenditures and rentals, the company will not need to resort to its capital. The veriest beggar might lease all the buildings in New York and pay his rents promptly, if he should receive more than he paid for rentals. But the company will probably have occasion to construct some lines and improve and equip others, and to raise money for such purposes the combination of such an array of capitalists will have great advantages.

Manhattan & Northwestern.

Mr. A. L. Mortimer, the Chief Engineer, with a considerable party, is making surveys for the line of this road from Manhattan north, in the valley of the Big Blue, to the Nebraska line. The President reports that he is promised capital sufficient to construct the road so soon as the country on the line has subscribed at the rate of $5,000 per mile.

St. Croix & Superior.

Reports from Washington state that there is a fair prospect that the bill extending the land grant to this company will pass, both Senate and House committees having reported in its favor.

Burlington & Missouri River.

The sale of this company's lands in Iowa during the month of January, 1872, were 892 13-100 acres, at an average price of $11.55 8-10 per acre, amounting to $10,311.80-100. The total sales to February 1, 1872, are 160,511 74-100 acres, at an average price of $11.74-100 per acre, amounting to $1,884,509.11-100.

Pullman Car Works in Canada.

The London *Free Press* asserts that the Pullman Company has purchased 75 acres of land just outside of that city, on which to erect works for the manufacture of its palace cars.

Cumberland Valley.

The report of Hon. Frederick Watts, President, says: "The Williamsport Extension and Potomac bridge is set down at a cost of $122,348.98. The extension of our road from Hagerstown to the canal at Powell's Bend, on the Potomac, has been completed, except the siding which reaches down to the canal, which will be finished in a very short time, giving us connection with the Chesapeake & Ohio Canal. The abutments and a large part of the foundations and piers of the bridge have been built, and the bridge itself is nearly completed by the Keystone Bridge Company, and it will require little time to put it up whenever the piers shall be finished. The road of the Martinsburg & Potomac Railroad Company is in a state of forwardness, and will be completed by the time the bridge over the river may be passed, whereby we will be connected with the Baltimore & Ohio Railroad at Martinsburg, giving the people of our valley a direct communication with the West by Pittsburgh, Wheeling or Parkersburg."

Canada Southern.

It is reported that the contract for the construction of the dock on the Canada side of the river, at the termination of the St. Clair Branch of the Canada Southern, has been let, so much thereof as will permit the landing of two locomotives and a cargo of railroad iron to be done by May 1, the balance by July 1.

Sheboygan & Fond du Lac.

The Detroit *Tribune* says: "On a recent visit to Milwaukee, Hon. James F. Joy perfected arrangements for a new steamship line across Lake Michigan. In the spring the Sheboygan & Fond du Lac Railroad, in which Mr. Joy is largely interested, will put on a line of boats between Milwaukee and Sheboygan, running from thence across to Lake Pentwater, thence to Grand Haven, at the latter place connecting with the several roads that make that place their terminus."

The shortest outlet for such a line will be the Detroit, Lansing & Lake Michigan Railroad.

Owosso & Northwestern.

The Detroit *Tribune* says:

"The original intention to go to Big Rapids is abandoned, and four directors along that proposed route have resigned and their places have been filled by three gentlemen nominated by and representing, respectively, the Detroit & Milwaukee, the Jackson, Lansing & Saginaw Company, and the Great Western Railway, and I. A. Fancher, of Mt. Pleasant. The road is to be extended to Mt. Pleasant, if the citizens of Isabella County will raise and give them $25,000, of which $13,000 had been subscribed at last accounts. The line has been definitely located as far as Alma, Gratiot County, and will probably be built at least that distance this season."

Lansing & St. John.

The Detroit *Tribune* says that this Michigan project is being vigorously worked up. There have been $53,000 in good subscriptions already obtained. Lansing is now asked to procure the right of way, grade, put in the culverts on that portion of the line between that city and the county line, about two and a half miles, and costing from $12,000 to $15,000. St. John and the Clinton county towns interested will complete the road-bed thence to St. John. The road, it appears, is intended to be a branch of the Lake Shore & Michigan Southern's new line, the Northern Central of Michigan.

Wisconsin Central.

The Winona (Minn.) *Republican* says:

"Messrs. N. & J. M. Staughton, the railroad contractors of this city, have taken the contract for thirty miles of railroad on the Wisconsin Central. They are to build from Ashland southeast, their contract including grading, bridging, etc., which they will commence forthwith. The object of the company in starting from Ashland is to reach the iron regions and develop the country in time for the business of the coming season of navigation."

The Menasha *Press* says: "Car load after car load of iron for the western extension of the Wisconsin Central Railroad is being shipped daily from this place to Stevens Point. The bridge over the Wisconsin River, which has been in process of erection for several months, will be completed this present week, and by opening spring on over forty miles of track west of the Point regular trains will be running."

Norfolk & Southern.

The Virginia Legislature has chartered this corporation, with power to construct a railroad from Norfolk south to any point on the North Carolina line east of the county of Nansemond.

Mineral Trunk Railway.

A company of this name filed a certificate of incorporation with the Secretary of State of Ohio on the 29th ult. The termini of the road are the villages of New Lexington and Ferrara, both in Perry County. The capital stock is three millions of dollars, divided into shares of fifty dollars each. Its incorporators are James Buckingham, A. M. Houston, Jas. Taylor, G. B. Johnson and John F. Parsons.

Michigan Midland.

Mr. Kitton, the President of this company, and Mr. Thompson, President of the Canada Southern, have been in Grand Rapids canvassing for the Midland. It was proposed to build the Midland to Holland, passing eight or ten miles south of Grand Rapids, and to have a branch to Grand Rapids; but the Grand Rapids people clamored for the main line, and the Grand Haven people asserted that they had the best harbor on the lake and insinuated that vessels drawing 6½ feet sometimes couldn't get into Holland harbor, and the two presidents conceded that perhaps the Midland might go through Grand Rapids and to Grand Haven, after all.

South Carolina Railroad.

The Augusta (Ga.) *Chronicle and Sentinel* says that a controlling interest in this railroad has been purchased by New York capitalists, with Moses Taylor at their head. The Charleston *Courier*, however, says that the transfers made are by no means sufficient to control the company, but intimates that there is some fear of such a change, and that the Central of Georgia was proposed to lease the line.

Chicago, Dubuque & Minnesota.

The Dubuque *Herald* of the 25th ult. says:

"Track-laying has not far advanced beyond McGregor, though its terminus is now somewhere between North McGregor and Lansing. Grading is finished to the State line, and is being carried into Minnesota. La Crescent is the point to be reached to make the route continuous to St. Paul. There it connects with the Chicago & St. Paul road, which runs from there northward into the latter city. And there are now only twenty-three miles of grading to be done between the State line and La Crescent to have the way clear for putting down the iron. Wednesday afternoon, President Graves notified the Superintendent of the Chicago & St. Paul road that the Chicago, Dubuque & Minnesota road would meet them at La Crescent with the cars between the 1st and 15th of June next."

St. Louis, Council Bluffs & Omaha.

It is reported that a contract for the extension of this branch of the St. Louis, Kansas City & Northern from its present terminus at Pattonsburg northwest to Marysville, about 45 miles, will be let immediately.

Pennsylvania Dividends.

The Philadelphia *Public Ledger* of the 1st inst. says:

"The coupons due to-day on the 6 per cent. bonds of the Camden & Amboy Railroad, on the 6 per cent. bonds of 1887 of the Belvidere & Delaware Railroad, on the 6 per cent. bonds of 1897 of the Camden & Burlington County Railroad, will all be paid to-day at their usual places of payment. The coupons of the Catawissa Railroad new 7's of 1900, the coupons of the 2d mortgage 7's of the Huntingdon & Broad Top Railroad, and the coupons of the 1st and 2d mortgage Warren & Franklin Railroad 7's all mature and are payable to-day. The Delaware Division Canal Company has its semi-annual dividend period this month, as has also the Morris Canal Company on its common and preferred shares."

Memphis & Knoxville Air Line.

A preliminary survey for this proposed narrow-gauge railroad has been commenced. The chief work now, however, is the soliciting of private and county subscriptions to the stock.

Southern Dakota.

An arrangement has been made by which this company will have the use of the Sioux City & Pembina Railroad as far north of Sioux City as is desired, probably 12 or 15 miles. The Dakota section of the Southern Dakota is to be completed by the 1st of November.

Atlanta & Richmond Air Line.

The Gainesville (Ga.) *Eagle* states: "The survey and location of the air-line road, which has recently been completed, show the following elevations above tide water: Atlanta, the starting point, 1,105; Gainesville, 1,297; at Mr. Kinsey's, 28 miles east of this place, the highest point on the line, 1,616; the Tugalo River, at the crossing, 700, which will be crossed on a bridge only 30 feet high; Greenville, S. C., 1,050; Spartanburg, 1,050; at King's Mountain the elevation is the same as it is at Gainesville; Charlotte, N. C., 850. The greatest divergence from an air-line is at Mr. Kinsey's, which is a little over four miles. The line runs within two miles of Toccoa Falls, and fourteen miles from Tallulah Falls. The distance from Atlanta to Charlotte is 260 miles. The line skirts the mountains for two hundred miles, and yet there will not be a tunnel on the road, and the heaviest grade will be 52 8-10 feet per mile. The whole line is now under contract, with over 3,000 hands at work. It is the intention of the authorities to have the cars running through by the first of November next."

Lookout Mountain Railroad.

A combination of the Chattanooga Coal and Iron Company, the Trion Railroad Company and the Lookout Mountain Railroad Company has resulted in an organization under the above name. It is proposed to construct a new railroad from Chattanooga south to Rome, Ga., about 60 miles, over a difficult country. It is reported that $190,000 is secured from Chattanooga and two counties, and that its charter provides for State aid at the rate of $15,000 a mile.

New Railroads in Mississippi.

The Jackson (Miss.) *Clarion* gives the following list of new projects in that State:

"First—The Memphis & Selma road. Work is progressing on this road on both ends of the line. It is being pushed rapidly forward to Holly Springs from Memphis.

"Second—The Mobile & Northwestern road. The contracts for this road have been let out, and the work is now progressing on the Mobile end and will soon be begun on the Helena end.

"Third—The Vicksburg & Memphis road. This road, which will tend so much to develop the Mississippi valley and open it to the world, bids fair to be a success. Contracts for the first twenty miles have been let out.

"Fourth—The Grenada, Houston & Okalona road is being pushed rapidly forward, and will in all probability be completed in twelve or eighteen months.

"Fifth—The extension of the New Orleans, Jackson & Great Northern road. The work is progressing on this extension between Canton and Kosciusko, and the survey is being made beyond the latter point.

"Sixth—The Natchez & Jackson road. This road, which is destined to re-connect Natchez, once the largest and most beautiful city in our State, with the outside world, will doubtless soon be under progress of construction. The first ten miles of the work has been contracted for.

"Seventh—The Ripley road. This is purely a local road, about twenty miles in length, and will connect Ripley, Tippah County, with the Memphis & Charleston Railroad. The contracts have been given out.

"There are many other roads of importance projected and chartered, among which we will name the Meridian & New Orleans, the Ship Island, the Meridian & Grenada, which will be an extension of the Mississippi & Tennessee, the Vicksburg & Pensacola, the Meridian & Red River, the Crystal Springs & Yazoo City."

Lake Ontario Shore.

A company has been organized to construct a railroad from a point on the new Syracuse Northern Railroad

near Syracuse, west by north through Baldwinsville to a junction with the Lake Ontario Shore road in Wolcott, Wayne County, 32 miles. Such a road would afford the Shore road a branch to Syracuse and a section in a very desirable outlet to New York, either through the Midland or the Rondout & Oswego, by either of which the distance to Niagara River should be less than by the Central.

Texas Pacific.

George Alfred Townsend, the Washington correspondent of the Chicago *Tribune*, in a recent letter, makes the following statements:

"Marshall O. Roberts has already grown weary of the Southern Pacific task, and has offered to sell out his franchise, etc., to Thomas A. Scott, for $1,500,000—the sum advanced by Roberts to retain the charter nearly forfeited by Fremont's misdoings, and spent among the Texas Legislature last winter. Scott has been in the city several days, endeavoring to ascertain what liabilities Roberts and Fremont have made here. Last winter the State of Texas voted a large money subsidy to this road—not a dollar of which, however, was to be paid until the road should be completed for the whole 600 miles across the breadth of the State. Two or three land subsidies, besides the government subsidy, will accrue to the road; but it will take the first 150 miles of the lands to compromise with Fremont's bondholders, who were duped by his agents in Paris."

The directors are to hold a meeting next Tuesday, February 13, at their office, No. 177 West street.

Paducah & Memphis.

This company advertises for proposals for grading, bridging, track-laying and the delivery of cross ties and timber on the section of the road from Memphis northward to Covington, 37 miles, which will be received at the office of the Chief Engineer in Memphis until March 5 at noon. Plans, profiles and estimates can be seen at that office.

Toledo & Maumee.

This company filed articles of incorporation with the Secretary of State of Ohio on the 2d inst. The termini of the road are the city of Toledo and Maumee City, both in the county of Lucas. The amount of capital stock necessary to construct the road is $250,000. The corporators are D. F. Cook, O. White, William Ligerson, R. B. Mitchell and Marton Graham.

Flint & Pere Marquette.

The following table shows the shipments of the products of the Saginaw Valley, from all points on the Flint & Pere Marquette road, for the years 1870 and 1871:

	Lumber.	Staves.	Shingles.	Lath.
1871	77,707,000	880,000	158,460,000	4,080,000
1870	61,867,000	1,536,000	97,515,000	4,050,000
Increase	15,840,000	.....	60,945,000	30,000
Decrease	.....	656,000	.....	.....

The shipments of salt in 1870 were 11,039 barrels, and in 1871 16,835 barrels, an increase of 5,796 barrels.

This company has been surveying a route for a branch from its line at Farwell, Clare County, northwest 50 or 55 miles to the Grand Rapids & Indiana Railroad at the point where the Traverse City Branch will join it.

Cleveland, Mount Vernon & Delaware.

A correspondent of the Cleveland *Herald*, under date of the 22d ult., says:

"You will be glad to hear that the work on the Cleveland, Mt. Vernon & Delaware Railroad is progressing satisfactorily. The rails are laid from Mt. Vernon to the west bank of the river at this place, and a construction train is running daily. The track being ready for several miles east of here, the rails will be laid, I understand, at the rate of a half mile per day."

The Pennsylvania in New England.

Statements have been made in New England papers to the effect that the Pennsylvania has control of the European & North American and is likely to gain possession of the Portland & Rochester, that it will connect these either by securing the Maine Central or by making a new line from Portland to Bangor, embracing the new line from Bath to Rockland, and that other lines within its reach will complete its route from the St. John River to New York.

Northern Pacific.

Jay Cooke & Co. report that the sale of the company's bonds in this country during January amounted to $1,513,400.

Grand Rapids & Indiana.

The price of this company's first mortgage bonds has been advanced to 96, only a few being unsold.

Hannibal & St. Joseph.

The Governing Committee of the New York Stock Exchange have ordered that no stock of this company shall be a good delivery on contracts at the Board, except on such certificates as have been already issued and countersigned at the office of Messrs. Duncan, Sherman & Co. This order will be in force until the transfer books are reopened and the stock duly registered in accordance with the rules of the Stock Exchange.

New Orleans, Little Rock & St. Louis.

A company has been organized in Arkansas to construct a railroad from Little Rock south by west to Camden, Ark., and then south through Homer, La., to a junction with the Shreveport Branch of the New Orleans, Mobile & Texas Railroad (which is yet to be constructed). This latter road would give it an outlet to New Orleans, and on the north the Cairo & Fulton and the St. Louis & Iron Mountain would give it a short route to St. Louis. This would complete a route from St. Louis to New Orleans, which, however, would be longer than the existing routes. Its value, however, would be as a route to the country on the line, now generally inaccessible by either of these cities, or any others, for that matter.

Portland & Ogdensburg.

Nine miles more of this railroad were opened on the 29th ult., completing one more link in the Vermont Division. Trains now run east from St. Johnsbury as far as West Concord, a distance of nine miles, and 43 miles of the road, in all, are in operation.

Connecticut Western.

This road has been made a regular mail route, and its trains commenced carrying the mails regularly on the 29th ult.

Sioux City & Pembina.

It is reported that the contractors, Douglas, Brown & Co., will grade this road from Sioux City north up the Sioux River to Sioux Falls during the current year, and have twenty miles of it in operation by October.

Missouri, Kansas & Texas.

Bates County, Mo., has voted $250,000 to this company in aid of a branch from the Sedalia Division at Clinton west by south through Butler, in Bates County, in the direction of Mound City, Kansas.

The extension from Sedalia eastward progresses favorably, and it is expected that it will be completed to Booneville before June. Contracts have been made for bridging the Missouri at Booneville, and it is reported that the Missouri, Kansas & Texas traffic will be sent to Chicago, Burlington & Quincy road, and to the east by the Toledo, Wabash & Western.

St. Louis & Iron Mountain.

This company's general offices were removed lately to a new building built by the president of the company on the corner of Fifth and Market streets, St. Louis, where they are located as follows:

Second story: Offices of the President, General and Assistant General Superintendent, Auditor, Treasurer, Train Dispatcher and Land Department.

Third story: Ticket Department and offices of the General Freight Agent, Assistant do. and Supply Agent.

Fourth floor: Offices of the Chief Engineer.

The "Parallel Railroad."

The New York & New Haven is the road to which this proposed road is to be parallel. It is claimed that such a road, being a few miles inland, would need no draw-bridges and so could run faster trains than the existing line. It is proposed to connect at New Haven with the Connecticut Air Line for Boston. About $300,000 has been subscribed to the stock, and towns on the line are discussing the project eagerly.

Association of German Railroads.

From a foreign journal we learn that at the beginning of the year the Association of German Railroads comprised 86 independent companies and State lines, of which 51, of the aggregate length of 2,815 German miles, in different States of Germany, 29 of 1,576.7 German miles in the Austrian dominions, and 6 of 302 German miles in other countries, the total length being thus 4,693.7 German miles, showing an increase of 602 German miles (2,860 English miles) over 1870. This increase was formed by the following railroads and sections being opened for public traffic, in Germany alone, during the course of last year: The sections Mannheim & Carlsruhe and Freiburg to Alt-Breisach, belonging to the Baden State Railways; from Nürnberg to Neumarkt, on the Bavarian Eastern Railway; from Haidhausen to Neu-Otting, from Munich to Rosenheim and from Neu-Otting to Sembach, on the Bavarian State Railways; from Arnsberg to Meschede, on the Bergisch-Maerkisch Railway; from Lüben to Nieder-Zarkow, from Neider-Zarkow to Glogau, and from Glogau to Rothenberg, on the Breslau Schweidnitz & Freiburg Railway; from Herzberg to Osterode, on the Hanoverian State Railways; from Ober-Ramstadt to Reinheim, from Reinheim to Wiebelsbach, from Mainz to Arnsheim, and from Wiebelsbach to Erbach, on the Hessian Ludwig's Railway; from Osnabrück to Münster, on the Cologne & Minden Railway; from Berlin to Lehrte, and from Aschersleben to Connern, on the Magdeburg & Halberstadt Railway; the Berlin Ring Railway, belonging to the Neiderschlesisch-Maerkische Company; the Sagan & Sorau, on the Lower Silesian Branch Railway; the Fulda & Lauterbach, on the Upper Hessian Railway; and the Breslau & Strehlen, on the Upper Silesian Railway.

Memphis & Paducah.

This company, formed recently by the consolidation of the Paducah & Gulf (in operation from Paducah to Troy, Tenn., 63 miles) with the Mississippi River Railroad Company, which has a considerable amount of grading done from Memphis northward, has made arrangements for the completion of the section between Memphis and Covington, and expects to have this section completed to Troy, so as to open a through line from Paducah to Memphis. Col. H. S. McComb is interested in the new company, and it is supposed that the Pennsylvania will have some power in its management.

New Orleans & Texas.

This company, it is reported, has closed a contract for the construction of an extension of its road from the present terminus at Brashear west to the Saline River, where it will meet the line of the old Texas & New Orleans road, which, however, must be rebuilt for a considerable distance before it can be used as a connection.

Missouri Grain Shipping Law.

The Missouri Legislature has passed a law substantially like that of Illinois concerning shipments of grain by railroads, and providing that facilities shall be supplied for weighing grain and that it shall be delivered at any elevator to which it may be consigned.

Logansport, Crawfordsville & Southwestern.

This company's bonds have been offered in the New York market for a few weeks through Jones & Schuyler, of No. 12 Pine street, and have met with such favor and have sold so readily that the price was advanced last week from 92½ to 95. The road lacks but little of completion, and is likely to have a considerable traffic in coal northward and pine lumber southward.

Eastern Railroad.

It is reported that four-fifths of the claims against the Eastern Railroad, resulting from the Revere disaster last year, have been settled, none of them having come into court.

The company has recently completed a second track as far as Ipswich, 27 miles from Boston.

At the stockholders' meeting on the 5th inst. it was resolved to issue bonds not to exceed $1,500,000, and to postpone the election of directors until February 15. President George M. Browne declined re-election to any office.

Boston, Barre & Gardner.

The first report, up to the 1st of January, 1872, shows a capital of $718,790, of which $707,000 is paid in. The cost of building the road, including rolling stock, was $759,188, and the present liabilities are $70,056, while the assets in excess of the liabilities are $2,985. The earnings of the road thus far have been $27,442, and the general expenses $8,870.

Lexington, Lake & Gulf.

The stockholders of this Missouri company have ratified a contract with the Burlington & Southwestern Company to iron and equip their road. The arrangement looks to the building also of a line to Kansas City from Lexington. The contract provides for the completion of the road from Iowa to Lexington within two years from the first day of January, 1872, and also the track-laying shall commence at Lexington five months from the first day of February, 1872, and be prosecuted in good faith, and cars to run to Butler in a reasonable time.

Lee & Hudson.

It is reported that the Boston & Albany Company has agreed to lease this proposed road when completed. The proposed route is from Lee, Mass., on the Housatonic Railroad 11 miles south of its junction with the Boston & Albany at Pittsfield, nearly due west to the Hudson River at Hudson, crossing the Boston & Albany road near West Stockbridge.

Southern Pacific.

The *Southwestern*, of Shreveport, La, says 160 miles more of the Southern Pacific Railroad is to be immediately put under contract. This 160 miles will extend the road from its present terminus at Longview, westward through Dallas, crossing the Clear Fork of the Trinity River at a point about forty miles west of Dallas, where it is expected the Trans-Continental will intersect it.

Lafayette, Muncie & Bloomington.

There has been a disagreement between this company and the contractors for the section of the line between Lafayette and the Illinois line, Messrs. L. A. Dauby & Co., which threatened to become serious and delay the opening of the road, but the last reports are that a settlement of all claims has been made.

New London Northern.

The Vermont Central, the lessee of this road, will, it is reported, soon build a new round-house at New London with stalls for 35 locomotives.

Great Southern of Florida.

The Board of Trustees of the Internal Improvement Fund of Florida have revoked the land grant to this company, which, under the presidency of Rev. A. C. Osborn, made some noise in Congress two or three years ago.

Norfolk & Lynnhaven Bay.

The Norfolk *Journal* says that a company has been formed and is prepared to construct a railroad from Norfolk to the mouth of Lynnhaven Bay, about eight miles.

Colorado Mineral Railway.

A narrow-gauge railroad is proposed through some of the most productive mines of Colorado from Georgetown through Central City, and across the coal fields of Boulder County to a connection with the Denver Pacific, having a length of about 120 miles. The object is chiefly to carry ore to the coal mines, where it may be smelted.

There are nine incorporators, consisting of the following gentlemen: Jerome B. Chaffee, M. C., President First National Bank, Denver; Charles S. Richardson, Civil and Mining Engineer, Central City; Fred. A. Clark, Esq., Denver; Sir Cecil Beadon, 21 Winchester street, London; General R. E. Carr, President Kansas Pacific Railroad; Charles Callender, Esq., New York; James Archer, Esq., St. Louis, President Denver Gas and Water Works; Walter S. Cheeseman, Esq., Vice-President Denver Pacific Railroad; Frank J. Marshall, Esq., President Marshall Tunnel Company, Georgetown.

Alabama & Chattanooga.

A correspondent of the Selma (Ala.) *Times* reports as follows a conversation with Mr. J. C. Stanton, who was the active man in the company constructing this road, and its Superintendent:

"He says he is a Republican; was a warm personal friend to Gen. Clanton; was worth five hundred thousand dollars when he went to Alabama; he expended four hundred thousand dollars of his private fortune in the construction of the road, and is poorer than when he undertook the job; Governor Lindsay offered to continue him as Superintendent of the road at a salary of $15,000 per year; no proposition was ever made to him that for a consideration the road would not be seized; he was offered $500,000 by Governor Lindsay and $400,000 by Tom Scott to withdraw from the road; he had nothing to do with the finances of the company; Loomis, financial agent, "went back" on the company, and that was the reason they failed to pay the interest on the bonds; he brought $150,000 South to pay the employes; $20,000 was paid to secure the passage of the bill in the Alabama Legislature; no money was paid as a bribe; the negro members cost $5 or $10; he knows nothing about the State bonds; he was making $75,000 per year at home—hence he could not come South for $15,000; he is still Superintendent; he will appeal to the Supreme Court for redress, and is certain of gaining his point; if the road is properly managed (by him) it will pay interest on bonds,

floating debt and all other debts; the profits for the first week were $16,887.95; second week, $27,221.55; third week, $31,227.65; Tom Scott, of the Pennsylvania Central; Dick Wilson, of the East Tennessee; Jesup, a New York banker; McCombs, of the Great Northern, are trying to "ring" the road; Lindsay, Busteed and Spencer are working in the interest of these parties; the road is in a wretched condition and losing money every day."

Winona & St. Peter.

The St. Paul *Press* reports that the contract has been let to De Graff & Co. for extending this railroad from New Ulm to the western boundary of Minnesota, a distance of 108 miles.

De Graff & Co. have commenced the construction of a bridge for this railroad over the Minnesota River at New Ulm. It will be 3,700 feet long and is to be completed by the 20th of February.

North Shore Railway of Canada.

A Montreal paper recently reported that this project was dead, but a Quebec letter says that a contract for its construction has been let to New York and Boston contractors, and that the work will be commenced as soon as the frost is out of the ground and completed in two years. The route is down the north side of the St. Lawrence from Quebec to Montreal.

Union Pacific.

A telegram from Omaha, dated January 31, says:

"There was recorded at this place, to-day, the deeds of lands from the city of Omaha to the Union Pacific Railroad Company, which had been purchased by the city at a cost of $200,000, and which, in addition to $250,000 in Douglas County (Neb.) bonds, have been delivered to the railroad company. The contract with and consideration from that company embodied in the deeds being that it will construct and maintain a railroad bridge over the Missouri River at Omaha; that the eastern terminus of the Union Pacific Railroad shall be and remain at Omaha; that all the transfer of freight, passengers, baggage, mails and express matter east and west, shall, after the completion of this bridge, be made upon the grounds donated in this city; that the Union Pacific Railroad Company will, within one year, expend on depot buildings upon these grounds not less than $100,000; all machines, car shops and general offices of the company to remain at Omaha.

"Nine of the eleven spans of the bridge are already completed, and the other two are in progress, and will probably be completed by the 1st of March next, so that trains will pass over the bridge."

The Iowa Legislature have passed a resolution charging this company with violating Congressional enactments in locating their terminal station in Omaha instead of Council Bluffs, and appointed a committee to investigate the subject and report the steps necessary to oblige the company to comply with the act of Congress. Messrs. Allen and Stone, of the Senate, and Beresheim, Gear and Duncombe, of the House, form the committee.

Virginia & Kentucky.

The survey for this extension of the Atlantic, Mississippi & Ohio Railroad was commenced at Bristol, Va. (on the Tennessee line), January 23.

Richmond & York River.

A Richmond correspondent gives currency to a rumor that this railroad has been purchased by English capitalists, which would be an odd thing for English (or other) capitalists to do.

Burlington & Missouri River.

This company is prepared to carry freight to St. Louis in connection with the St. Louis, Kansas City & Northern (late North Missouri), as appears by the following telegram from the General Freight Agent dated February 1: "I will try the experiment of allowing our cars to run to St. Louis, and will make the rate 35c. on grain from all our stations east of and including Glenwood on the main line, and Riverton on the Red Oak branch." This is an excellent time for St. Louis to develop a trade with the country on this line, as the Chicago elevators are practically full and there can be very little grain shipped to that city until the lakes open. On the other hand, St. Louis has scarcely any warehouse room to fill, and the closing of the Mississippi (which has lasted an extraordinarily long time) prevents for the time shipments southward.

Mobile & Northwestern.

Captain Ira Taylor commenced work, with 100 men, January 21, on the Mobile & Northwestern Railroad, at the Mississippi River opposite Helena, Ark.

Minnesota Northwestern.

This railroad, which is graded from the Southern Minnesota at Wells northwest to Mankato, will, it is reported, be ironed the coming spring.

Cairo & Fulton.

Regular trains commenced running on this road from Little Rock northeast to Little Red River, 50 miles, on the 1st instant.

Atchison, Topeka & Santa Fe.

The iron for the northern extension is arriving and will be laid as soon as the weather is mild enough, and, it is expected, trains will run through between Atchison and Newton by the 1st of April. The company has ordered eight new locomotives.

Peninsular of Michigan.

A correspondent of the Detroit *Tribune*, writing from Cassopolis, Mich., says:

"Messrs. Hopkins & Carpenter, of New York, who have been under arrest in this village during the past two weeks, on a writ of *ne exeat* issued in behalf of the Peninsular Railroad Company, were discharged from custody about midnight Monday. They drove to Dowagiac and took the Atlantic express for New York. The matter of difficulty between them and the Peninsular Railroad Company has been settled by them turning over to the company all of the bonds and stocks in their hands. The bonds in England have been deposited in one of the London banks, payable to the order of the Peninsular Railroad Company, and those in New York have been handed over to friends of the road in New York. Something over $2,000,000 was involved in the controversy."

Lake Erie, Wooster & Muskingum Valley.

This company recently incorporated in Ohio proposes to construct a line from Grafton (on the Cleveland & Columbus road 26 miles southwest of Cleveland) nearly due south to the Pan-handle road at Coshocton, through Lodi, Burbank, Wooster and Millersburg.

Winona & Lake Superior.

A project is discussed for a railroad from the Mississippi opposite Winona a little east of north to Ashland, Lake Superior. Such a line would be about 100 miles east of the Lake Superior & Mississippi road.

Vermont & Massachusetts.

The twenty-eighth annual report of the directors of the Vermont & Massachusetts Railroad Company states that the income for the year ending September 30, 1871, was $562,238.08; and the net income, after deducting all expenditures, United States tax, State tax and interest, $105,886.75. The directors say:

"Our earnings fall far short of a fair remuneration for the use of the capital invested, and this will continue till the Hoosac Tunnel shall be completed, and a through line is established. Although business at present is not sufficient to make an adequate return for the expenses incurred, we do not feel at liberty to diminish these expenses by taking away any of the accommodations which our various and long-established trains have afforded to passengers and freighters, or by avoiding any outlay that safety and public convenience may require. Since the close of the financial year we have even made a large reduction in our through and local passenger tariff. Our rates have been unaltered for many years, and this reduction seemed to be in accordance with the spirit of the times. The amount of reduction in a passenger business equal to that of last year would be about $25,000. We do not expect that proportion of actual loss in the future, as business will be likely to be increased by the reduction."

The directors, discussing the completion of lines which will make their road part of a through route from Boston to Troy, close their report as follows:

"It has been a long and expensive struggle to build parts at least of this through line, including the Troy & Greenfield Railroad and Hoosac Tunnel. But the corporations in the line have steadfastly persisted in their efforts, and they now have a certain prospect of early success in opening a new and valuable route through the northern part of the State. Whatever schemes may be got up to take from Massachusetts or her citizens the control, management and benefit of this line, will, without doubt, meet with little encouragement from our Commonwealth, which, at all times and against all opposition, has always been a fearless friend of the enterprise, and has from time to time taken such wise steps in relation to it that all obstacles, however formidable, have quietly disappeared."

Superior & St. Croix.

The Superior City *Times* says: "The profiles of the Superior & St. Croix Railroad, running from this city to the junction of the Northern Pacific, are about completed, and the chief contractor, Capt. Starkey, is busily engaged in forwarding men and supplies for the work. On Friday last the work of clearing and making square timber, cord wood, etc., was commenced by Messrs. McLean, Monroe & Doyle, experienced sub-contractors, who have taken two miles at the crossing of Pokegama Creek."

Milwaukee & St. Paul.

This company has commenced the construction of a new freight-house on the upper levee at St. Paul. It will be 480 feet long and 110 wide, and is to be completed next April.

THE SCRAP HEAP.

New Cattle Car.

The Springfield *Republican* says:

"S. W. Remer, Superintendent of the Taunton Car Factory, has invented and patented a cattle car that will prove of great service to stock dealers. The car is 30 feet by 8, and is divided by movable partitions into four compartments, each of which will hold four animals. In these the cattle are tied side by side, so that those in one compartment face those in the next, while on top of the car is a kind of trough for grain and water, which can be filled like the boiler of a locomotive. By means of valves the water or grain can be brought to the cattle without removing them. When there are no cattle, the car can be used for carrying other freight by merely fastening up the partitions."

Car Burglary.

A bill has passed the Ohio Legislature making it burglary to break into a railroad car at night.

Toronto Union Depot.

The depot to be built in Toronto for $200,000 will not be for the Grand Trunk alone, but for all the roads entering Toronto. The *Canadian Monetary Times* gives the following description of it:

"To the southward, facing the bay, the building will present a splendid front, 468 feet in length, of stonework along the first story; above that it will be of red brick with white brick facings. The windows appear in pairs, giving the idea of a very handsome and effective design. The walls will be 35 feet high, and the roof another 20 feet higher. Over the main entrance will rise a handsome clock tower, 130 feet high, and there will be two small towers, 100 feet in height, over the east and west entrances respectively. The back building, along the north side of the station, in length the same as the front building, will be of red brick with white brick facings. The plan is that of two long buildings with about 80 feet space between them for three railway tracks, this space being arched over with an iron roof, 78 feet span, and so all covered in. Two of the tracks will be laid for both the 5ft. 6in. and the 4ft. 8½in. gauge, having three rails each, to answer the Grand Trunk, the Northern and the Great Western; and another track of four rails to answer the above two gauges, also the narrow gauge of 3ft. 6in. The two tracks next the bay will be principally for the Grand Trunk, the Great Western and the Northern, and the third track principally for the two narrow-gauge railways. To the north of the station buildings will be an excursion platform 500 feet in length and 20 feet wide. None but passenger trains will enter the station, tracks for freight trains being elsewhere provided. Here passengers going by the Grand Trunk, the Great Western, the Northern, the Grey & Bruce or the Nipissing Railway, will assemble to find their respective trains, and here passengers coming in by any one of these railways can step from its cars into those of any of the others, without exposure to the weather. The work is to be completed early next summer.

An Effective Brake.

An exchange has the following, which may not be quite true, yet quite worth reading:

"A man appeared lately in Mauch Chunk with a patent air-brake for railroad cars, for sale. He claimed that it would stop a train going at the highest rate of speed in half its own length. There was a certain railroad man also up there who treated this suggestion with scorn, and said he would wager large sums that the air-brake wouldn't stop a train any quicker than any other brake. So he borrowed the contrivance and fixed it on an open car on the Switchback Railroad, and went up to the top of Mount Pisgah to get a fair start. He let her come down the inclined plane for a while, until she began to move along at the rate of sixty miles an hour, and then he suddenly placed his foot on the brake, and put on with full power. One minute later the eye of any solitary traveler passing through those wilds might have observed a car standing perfectly still on the track, and a railroad man going down hill among the blackberry bushes and underbrush head foremost, at a rate—say of forty-six miles an hour. He was carried home on a stretcher, with an abiding faith in the success of the invention, but thinks its usefulness would be improved if some other man would improve upon the machine, so as to avoid the certain demoralization overtaking those who use it."

Heavy Locomotive Orders.

The Lake Shore & Michigan Southern Railway Company has recently ordered 131 locomotives. Of these, Mason, of Taunton, Mass., will build 20; Blood, of Manchester, N. H., 23; Healy, of the Rhode Island Locomotive Works, 26, and the balance have been given to makers in New York and Paterson, N. J.

St. Joseph Bridge.

On the 1st inst. the second pier of the St. Joseph bridge across the Missouri River was safely landed on the bed of rock, at the depth of sixty-six feet below high water. For some time the progress has been slow, owing to the caisson meeting with a three feet stratum of water-bearing gravel. This gravel bed contained specimens of rich gold-bearing quartz, topaz, amethyst, whinstone and other relics of the glacial period. The air pressure in the caisson during the last day was twenty-four pounds to the square inch.

Prices of Rails in January.

Bigelow & Johnston, of No. 48 Pine street, report as follows the prices of rails in New York for the month of January:

	Gold.	Currency.	Import, Tons.
New Rails.			
English	$62 @ 63		8,296
American		$71 @ 73	
Total import this month.			8,296
Same time 1871			10,040
Old Rails.			
Double heads	$43½ @ 44		
T or Flange	$42 @ 42½		
U or Bridge	Nominal.		4,163
Total import this month.			4,163
Same time 1871			4,058

In their circular the firm make the following comments:

"*New Rails.*—As we expected, buyers are at last awakened to the actual position of our market, and now recognize to a certain extent the necessity for a great advance here to bring our prices to a level with those ruling abroad. There has been considerable inquiry during the month with moderate sales at rapidly advancing prices. In American rails the sales have been large, but at prices which are out of all proportion to the increase in cost of raw material. If our mills are to hold their own there must be a decided and heavy advance in prices before long.

"*Old Rails.*—The bulk of arrivals during January have gone into store. Prices have advanced to meet as far as possible the enormously enhanced cost abroad.

"Consumers are reluctant to admit the necessity for the new scale of prices, but it has been foreshadowed for months, and we can only regret that the manufactured article does not advance *pari passu*."

The Narrow-Gauge in India.

The following is an extract from the address of Thomas Hawksley on his election as President of the Institute of Civil Engineers, London, January 9, 1872:

"The existing railways of India are now both extensive and important, and at present possess the advantage of a uniform gauge of 5½ feet. This audience will therefore be surprised to learn that this existing uniform gauge is now to be departed from, and that upon the obviously crotchety suggestion of some unknown individual. The French meter gauge of 3 feet 3⅜ inches is in future to be employed.

"In India there is about to be introduced the very evil consequent upon the absence of uniformity of gauge from which the wise and deliberate action of an experienced private enterprise in England is now busied in effecting our emancipation."

American Cars in Scotland.

We notice an advertisement of a Glasgow firm in English papers offering for sale one of John Stephenson & Co.'s street cars, which the advertisers recommend as "complete, elegant and strong, very suitable as a pattern."

Kellogg Bridge Company of Buffalo.

This company has received the contract from the government for the iron work of the New York Post-office. It also has contracts for some important bridges on the Philadelphia, Wilmington & Baltimore Railroad, and also on the Sodus Point & Southern Railroad of New York, and orders for a large amount of bridge and trestle work for a railroad on Long Island.

River Steamer Explosions.

The St. Louis *Republican* gives the following list of explosions on the Mississippi and its tributaries and the number of deaths occasioned thereby since 1815:

Year.	NAME OF BOAT.	Number of lives lost.	Year.	NAME OF BOAT.	Number of lives lost.
1816	Washington	9	1857	Forest Rose	12
1817	Constellation	36	1857	Kentucky	3
1825	Teche	20	1857	Fanny Fern	20
1830	Helen McGregor	60	1857	Cataract	12
1836	Ben Franklin	29	1857	Buckeye Belle	8
1836	Rob Roy	17	1858	Titania	1
1837	Charlton	9	1859	Princess	70
1837	Dubuque	21	1859	San Nicolas	45
1837	Black Hawk	50	1859	Hiawatha	2
1838	Moselle	85	1860	John Calhoun	8
1838	Oronoco	100	1860	Sam Gaty	2
1838	General Brown	55	1860	Ben Lewis	23
1838	Augusta	7	1860	H. T. Gilmore	2
1839	George Collier	26	1861	Madonna	4
1839	Wellington	25	1861	Ben Sherrod	80
1839	Walker	9	1862	Pennsylvania	150
1840	Persia	23	1862	Monongahela	4
1844	Lucy Waller	25	1862	Com. Perry	1
1845	Elizabeth	6	1862	Advance	3
1845	Wyoming	13	1862	Igo	1
1845	Marquette	30	1862	Ollie Sullivan	3
1846	H. W. Johnston	74	1863	Maria	4
1847	Edward Bates	53	1864	Ben Levi	5
1848	Concordia	28	1864	Sultana	1647
1849	Virginia	14	865	Nimrod	5
1849	Cutter	6	1865	R. J. Lockwood	11
1849	Louisiana	150	1865	W. R. Carter	18
1850	St. Joseph	13	1865	General Lytle	12
1850	Anglo Norman	100	1866	Missouri	7
1850	Kate Fleming	9	1866	Phantom	11
1850	Knoxville	19	1866	Cumberland	8
1851	Oregon	18	1866	Harry Dean	5
1852	Pocahontas	8	1867	Eclipse	22
1852	Thomas Stone	40	1868	Magnolia	81
1852	Glencoe	60	1870	City of Memphis	11
1852	Saluda	27	1870	David White	5
1852	Franklin	20	1870	Silver Spray	36
1853	Bee	3	1870	Maggie Hays	13
1854	Kate Kinney	15	1870	Iberville	7
1854	Timour	19	1871	Judge Wheeler	9
1854	Reindeer	40	1871	W. R Arthur	60
1855	Lexington	30	1871	Rob Roy	1
1855	Lancaster	5	1871	Raven	7
1855	Heroine	3	1871	New State	1
1856	Metropolis	14			

This is a total of 3,809 deaths by 89 accidents—that is an average of 43 nearly to each accident. These figures would be much more instructive if we knew the number of passengers carried by steamboats on these waters during this period, of which, we believe, there is no record. It is, however, small compared with the number carried by rail in the same territory, and the risk of accident in traveling by water is unquestionably much the greatest. Commenting on these figures the St. Louis *Republican* says:

"By contrasting the number of casualties for a period of eighteen years preceding the passage of the law of 1852 by Congress, with the number of casualties for a period of eighteen years subsequent to the adoption of the law, we can then more readily perceive the difference. During the first-named period twenty-seven boats exploded their boilers, and 1,002 persons were killed. During a period of eighteen years subsequent to the passage of the law fifty-four boats met with disasters by explosion, and 3,100 persons were killed. These facts do not seem to teach the necessity of various inventions of registers, gauges and patent plugs, in order to prevent explosions on steamboats."

Ferris & Miles' Steam Hammer Works.

This firm have made the manufacture of steam hammers a specialty, and are now devoting themselves almost exclusively to that branch of their business. They have been extending their works and increasing their capacity for doing work, and will soon employ 100 men. They have ordered a 75 horse-power Corliss engine, have added new tools and machinery, and will soon occupy a foundry; are about extending their machine shop, and will thus double their producing capacity. Some of their principal orders are: One 2½-ton hammer, one of 2,500 lbs. and one of 650 lbs., and one punching machine for the Baldwin Locomotive Works; two 2,500 lbs. single-frame hammers—the largest hammers with single frames *and guides* built in this country—one 1,000 lbs. and two 250 lbs.; one 650 lbs. steel hammer for the Fairmount Steel Works of Philadelphia; another large establishment in Philadelphia is about putting in a 3,000 lb. hammer. The Cleveland (Ohio) Iron Co. is getting a 3,000 lb. hammer; McPherson, Willard & Co., of Bordentown, New Jersey, have ordered a 2,500 lb. hammer with very long stroke (4 feet). The Hinkley & Williams Locomotive Works, of Boston, are getting one of 1,700 lbs., with double frame; the Manchester (N. H.) Locomotive Works will get one of 2,500, one of 1,000 and one of 650 lbs. The Rhode Island Locomotive Works have ordered a small 350 lb. hammer, the Boston & Albany Railroad one of 650 lbs.; the Wm. Butcher & Co. new steel works, Lewiston, Pa., one of 1,000 lbs. and one of 350; Benjamin Athon & Co., Newark Steel Works, have running one 2,000 and one 1,000-lb. double-frame steel hammer, and one 125 lb. and one 1,700-lb. ordinary hammer. Hillis & Jones, of Wilmington, Del., have ordered a 1,000-lb. hammer and Jackson & Sharp, of the same place, a smaller one. The Cleveland, Columbus, Cincinnati & Indianapolis Railroad Company will get one of 1,000 lbs. They have orders from parties along the New York Central Railroad, Western Pennsylvania, Ohio, California, Canada and Cuba.

This firm also has orders for a lot of axle machinery for new axle works in Allentown, Pa. Messrs. Ferris & Miles contemplate confining themselves exclusively to the manufacture of steam hammers.

Punched vs. Drilled Rivet Holes.

There are two methods of forming rivet holes in boiler and other plates which are adopted in practice; these are punching and drilling. A considerable difference of opinion exists among engineers as to the relative merits of these two methods, some holding that punched and others that drilled holes are the better. It requires but little consideration to show that the forming of such holes is an important point in practice. We shall therefore endeavor to solve the problem involved and to demonstrate that the advantages and disadvantages of the two methods are not equally balanced, but that one possesses a decided superiority over the other. And we may state at the outset that our opinion is decidedly in favor of drilling, as forming better work, injuring the iron less, and consequently resulting in stronger joints and seams than punching. If we would wish to observe the results of punching on a large scale, we have only to examine some of the targets at Shoeburyness. The holes there range from nine inches to fifteen inches in diameter, and have been produced by very powerful machines, not driven by steam, but by gunpowder. This, it may be said, affords a very exaggerated notion of punching, but if it does, it none the less illustrates the results arising from the action of a small steam-driven punch upon a piece of boiler plate. We have seen some scores of these big holes punched, and except in the case of very superior plates—such as may now be seen on the 48-feet target, plated with 8-inch metal, recently penetrated by the 10-inch gun—the punching process results in one or more cracks and fissures, radiating from the shot-hole as a center. Now this is just what takes place—in a less degree, of course—in boiler plates and the plates of girders in which the holes are punched. Where, however, iron of a very superior quality is used, fracture of the surrounding parts may not take place. But the quality of iron necessary to insure this result is so rarely used in ordinary practice that sound punched work is the rare exception and not the rule.

Turning once more to the targets, we find the holes to have been made very rapidly and with greater economy than if a drilling machine equally powerful as the punch had been employed. And this is just the case with the boiler plates, and forms the secret of the preference for the punching system. Cheapness is the great consideration, as competition cuts down prices; and no matter whether it be a boiler that may burst or a bridge that may give way, the work must be turned out as cheaply as possible, in order that a saving of profit may remain to the good of the manufacturer. The advocates of punching say that drilling the holes comes more expensive and does not add to the strength of the iron, or rather that the plates are no stronger with drilled than with punched holes. But experiments prove the contrary, and some made a few years since by Mr. Barnaby, of the Admiralty, are very conclusive on this point. In one experiment with a piece of boiler plate with punched holes, the plate broke at 10.9 tons per square inch between the holes. It was a very good piece of iron, standing 20¼ tons per square inch in the unperforated plate. When the holes were drilled, the plate gave way at 11¼ tons, a small difference only, perhaps, but still a difference, and one which Mr. Barnaby, in many instances, found much greater, and in steel plates greater still. We quote the actual figures, low though they be, as being precise and definitely answering the objections of those who say that punching does not weaken the iron. The results of many experiments go to show how much the iron between the holes is injured. The superiority of the iron when the holes are drilled is mainly due to the fact that the punch breaks the iron in the neighborhood of the hole, whereas the drill does not.

Let us now, in fairness, see what further objections are urged against drilling by the advocates of punching. They assert that it is an error to resort to drilling, unless turned rivets are used. Some go so far as to say that it is unmechanical to put ordinary rivets into drill-holes. Again, they urge that in riveting hot rivets into drill-holes, there is a great uncertainty in getting the rivets to fill the holes, one cause being that the oil used in drilling is left in the hole. Then, say they, there are the sharp ragged edges, which have a tendency to cut into the heads; and, moreover, unless the ragged edges on the inside of the plates where they come together are dressed off, there is a fear of being unable to get a water or steam-tight joint. Now we are not inventing these reasons against our proposition that drilling is the best, in order to demolish them; they are such as have frequently been urged. They are, however, vague and questionable in theory—mere refinements of reasoning, in fact, and such as are easily upset by the results of practice with drilling. The fact is that, as we have before observed, it is after all only a matter of cost, and the difference in this respect between the two systems we believe to be very slight indeed. There can be no question but that with drilled holes the plates are far less injured than when punched, and, further, several plates can be drilled at the same time, which cannot be done with the punch. Here an important reduction is effected in the cost of drilled work, while the further result will be that the parts will fit more accurately together.

From what we have advanced there can be no doubt that holes drilled in wrought-iron plates decrease the strength of the metal much less than punched holes. The metal around the circumference of the holes must certainly be much less injured, and therefore leave more strength in the plate. The question really resolves itself into one of expense, which is slightly in favor of punching. But if, by drilling, say only ten per cent. of the strength of the remaining metal is saved, it is, in a professional point of view, well worth the extra cost. With drilling the engineer is practically certain as to the strength of the plates, but with punching he is by no means sure of the result, as various qualities of iron will be more or less weakened in addition to the metal actually punched out. Hard iron is, of course, more injuriously affected than soft iron. The most striking testimony, however, we can adduce in support of the correctness of our views, is perhaps the fact that much attention has of late been given to drilling machines in multiplying their productive capacity. Several of these multiple drills have recently been brought forward, and the effect, of course, will be to reduce the cost of drilled holes, as a number of holes can be drilled at the same time. This, together with the fact of being able to drill through a number of plates at the operation, will, we hope, lead to the abolition of punched holes. Engineers may then rest satisfied that their work will give in practice the results assigned to it in theory. Moreover, we shall probably hear of fewer boiler explosions, many of which are unquestionably initiated by the damaging action of the punch on plates which are none too good in their quality to begin with.

The remedy for the evil of punched holes is easy; let engineers specify for drilling, and let them see that their specification is followed by the manufacturer.—*Exchange.*

How to Deal with our Railroads.

We have spoken recently of the unwisdom and injustice of certain late legislative dealing with our railroads. We would hint now of the better way to make them serve the popular want and the public wealth. First, of course, their government by a general code of laws, open, of course, to revision by each Legislature, but embracing all common principles and regulations for the construction and management of railroads, applying to all alike, and administered in detail by courts or an executive bureau. But beyond this, and as a corollary of it, we have come to a time when both parties to the question, the public and the corporations, may well unite in a specific experiment, that we believe had its first suggestion in one of the early reports of Mr. Adams, the railroad student and commissioner. This is, in effect, that our trunk lines of railroad should join with the legislative and executive authorities, in a sort of bargain for a term of years, made up of a combination of restrictions on the roads or guarantees to the public, and of liberties to the roads or grants from the public. An arrangement, this should be, so balanced and guarded, that it must be for the interest of the roads to develop their property as generously as possible, and to multiply facilities for their popular use, while the public, on the other hand, must be protected by special limitations on overcharges either for passage or freight.

Thus, suppose the Boston & Albany road should go to the Legislature this year, and say: Here is a problem which we are as much interested as you can be in working out intelligently; let us unite in making an experiment after this fashion—you shall authorize us to increase our capital stock to $30,000,000, all of the money derived from which, whether distributed at par to the stockholders or sold in the open market at the current rates, shall be expended on construction—in new depot accommodations, in a third track, or in any other prominent facilities for doing our business; you shall also take off the limit of 10 per cent. upon our dividends; and, in return for all this, we will agree that you shall require us to carry passengers at not exceeding two or two and a half cents per mile; that the number and times of our passenger trains shall, within reasonable degree, be subject to the revision and order of the board of Railway Commissioners; that we will not charge more for local freights than for through; *and that the rates of freight on coal and all breadstuffs coming into the State from the West shall be put at or very near the cost, and limited in like manner with the rates for passengers.*

Such an arrangement as this, fairly carried out for ten years, we believe would do more to solve the railroad problem, as far as Massachusetts is concerned, than anything else that is possible now to be done. It would give the railroad managers an incentive to economy, to enterprise, to the development of all classes of their business; it would give the public low fares and low rates of freight on the chief raw materials coming into the State. Cheap coal and cheap food are the prime necessities of the prosperity and growth of Massachusetts. Such an arrangement as this with the Boston & Albany road would insure both of them to her at the lowest possible cost. It would thus be a good bargain for the public; we believe it would also be a good bargain for the road. It would practically secure it immunity from legislative interference for the time named; it would give it an opportunity to make and divide all the money it could earn, under, of course, the vital restrictions as to fares and freight, and the general laws of the State as to maintenance of track and service at a certain standard. It is possible that at first the road would not be able to earn its present 10 per cent. We think it would, but certainly, taking the years together, over which the proposed arrangement extends, we are sure its dividends might, with due enterprise and economy, average a still larger rate.

It is certainly hopeless for the public to seek the highest benefits from our railroads without offering them a temptation to growth, to improvement, to multiplication of facilities, in the opportunity thereby to make money. And, on the other hand, it is quite as hopeless to expect to maintain the prosperity and growth of our State, in the sharp conflict with States more largely endowed in resources, nearer markets, nearer food and fuel, nearer lumber and iron, without securing to our manufacturers and their workmen the raw materials of their business and their life at as near as possible the prime cost. The arrangement we have suggested undertakes to unite these two parties, to secure these two ends. Is it not worth while for both parties to come together and make it? Their fortunes are linked together; the roads cannot prosper without the State does; the State will not, unless the roads give, or are made to give, the facilities.—*Springfield Republican.*